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Features

Departments

No Longer the Outlier

Updating the Air Component Structure

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Outliers are those who have been given opportunities—and who have had the strength and presence of mind to seize them.

—Malcolm Gladwell
Outliers: The Story of Success

Having served on a COCOM [combatant command] operations directorate staff twice, worked within three air components, and now as commander of an air component, I've had the opportunity to observe the interaction of the air component with its respective COCOM and sister components. As a result of my experiences, I strongly believe the time has come for a change in our thinking to take advantage of our recent doctrine updates and make adjustments to the air component organizational construct.

—Lt Gen CQ Brown Jr.
Commander, US Air Forces Central Command
Combined Force Air Component Commander

Since the inception of the air operations center (AOC) during Operation Desert Storm, the command and control (C2) of airpower has evolved, but the mission has not changed. The Air Force continues to provide combatant commands (COCOM) with a highly competent air component that is capable of conducting and supporting air, space, and cyberspace operations within its assigned area of responsibility. The air component has succeeded at its primary mission of delivering airpower to the joint and coalition environment over the past 20-plus years in conflicts across the range of military operations.

The air component has been an *outlier*, when compared to joint and other component staffs, in its unique ability to C2 military operations in multiple and diverse areas of operations simultaneously. Despite the success in doing so, there is room for improvement. Doctrine and guidance have been slow to adapt to changes in the joint environment. Past doctrinal distinctions between Air Force forces (AFFOR) and the AOC placed the air component at a disadvantage, or worst-case exclusion, when addressing COCOM and cross-component operational issues. Additionally, the distinct differences and separation of the AFFOR and AOC staffs previously articulated in Air Force doctrine and instructions have created confusion and dysfunction for operational elements both inside and outside the air component. However, the November 2014 doctrine updates have opened the door to a new approach (fig. 1).

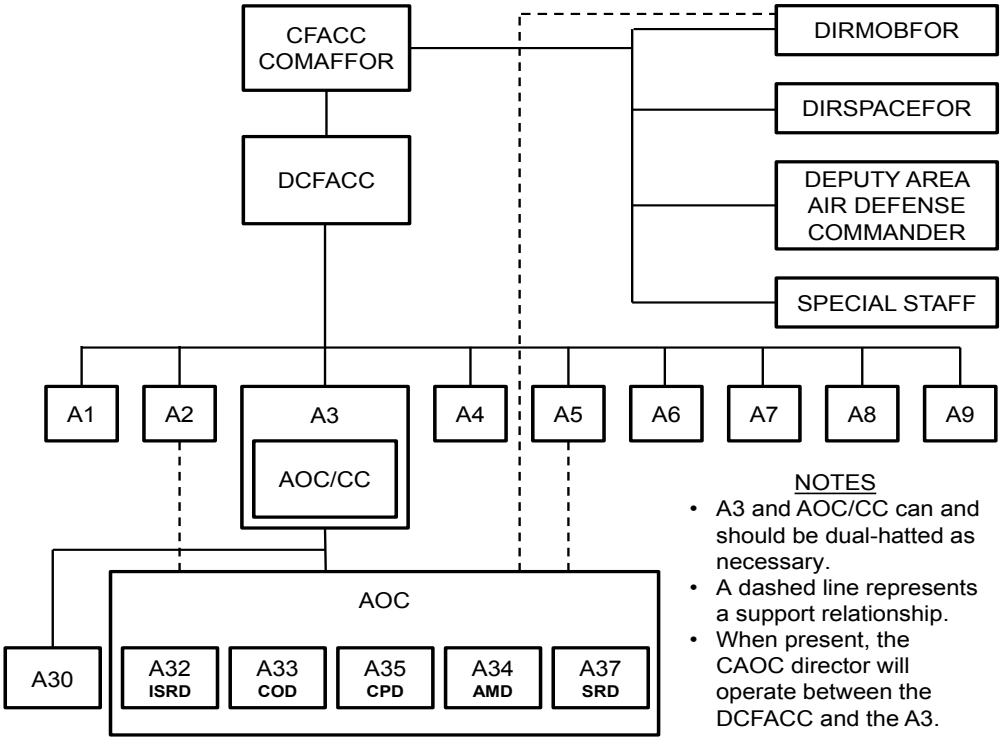

Figure 1. Proposed air component framework

CFACC - combined force air component commander
COMAFFOR - commander, Air Force forces
DCFACC - deputy combined force air component commander
DIRMOBFOR - director of mobility forces
DIRSPACEFOR - director of space forces
A1 - manpower, personnel, and services
A2 - intelligence, surveillance, and reconnaissance (ISR)
A3 - operations
A4 - logistics
A5 - plans and requirements
A6 - communications
A7 - mission support and installations
A8 - strategic plans and programs
A9 - studies, analyses, assessments, and lessons learned
AOC/CC - commander, air operations center
AFFOR - Air Force forces
ISRD - ISR division
COD - combat operations division
CPD - combat plans division
AMD - air mobility division
SRD - strategy division
CAOC - combined air operations center

With the exception of the air component's operational elements, the operations director (A3), and the AOC, the alignment of the A staff with its COCOM and sister components is clearly understood both in doctrine and in practice. For example, the relationships and alignment between the air component's manpower, personnel, and services directorate (A1) or logistics directorate (A4) and a joint staff manpower and personnel directorate (J1) or logistics directorate (J4) are well understood. When one compares the functions of the A3 and AOC divisions with the equivalent J3 structures in a typical joint staff, the understanding becomes less clear. To gain synergy across the air component's operational elements and better align with joint staffs, the air component structure should change by aligning the AOC within the A3 to *become an air component with a staff and operations center versus a staff and operations center that is an air component*.

The Air Component Today

The current AOC structure grew out of the Vietnam-era theater air control system (TACS). Following the Gulf War, when Tactical Air Command and Strategic Air Command merged to form Air Combat Command, the TACS formally transitioned to the AOC and was later established as the AN/USQ-163 Falconer weapons system. After the start of Operations Enduring Freedom and Iraqi Freedom, the Air Force identified the need for a formal training course and a standardization program. In 2004 AOC formal training programs began at Hurlburt Field, Florida. Additionally, the AOC-X at Langley AFB, Virginia, continues to shepherd the development of the weapons system by providing a standardized framework and test bed for new concepts.[1]

Building on the AOC history and current framework, the air component is a single entity made of up two elements—the AOC and the AFFOR—both charged with the C2 of air operations. Prior to the Air Force doctrine update in 2014, the dual nature of the commander, Air Force forces (COMAFFOR) as joint force air component commander (JFACC) was frowned upon, and a clear distinction was made between the staffs supporting the COMAFFOR and JFACC. In accordance with Joint Publication 3-30, *Command and Control of Joint Air Operations*, "the JFC [joint force commander] will normally assign JFACC responsibilities to the component commander having the preponderance of forces to be tasked and the ability to effectively plan, task, and control joint air operations."[2] However, as acknowledged in earlier versions of Air Force doctrine and historically executed, the COMAFFOR has normally been dual-hatted as the JFACC, not merely due to the preponderance of air forces but also due to the ability to provide C2 of airpower through the AOC. Conversely, doctrine had recommended avoiding dual- or triple-hatting the AFFOR staff to the maximum extent possible because of manning and the distribution of workload.[3] Until the recent doctrine changes, Air Force Doctrine Document 1 depicted an Air Force–preferred joint organization construct of a separate COMAFFOR and JFACC (fig. 2).

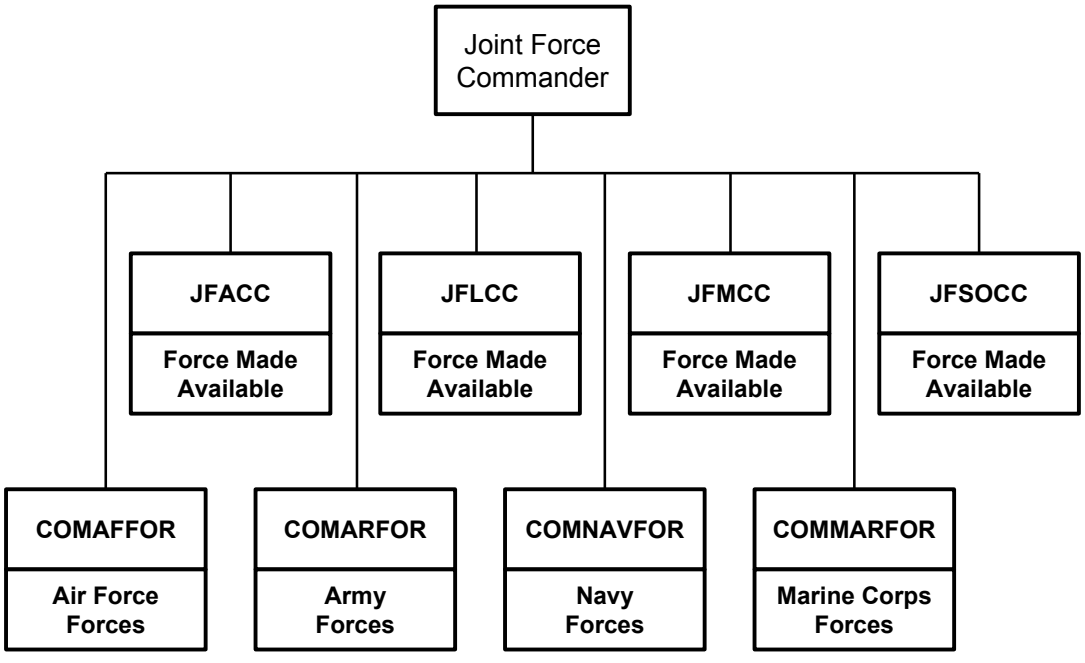

Figure 2. Joint force organization with functional and service components. (Reprinted from Air Force Doctrine Document 1, *Air Force Basic Doctrine, Organization, and Command*, 14 October 2011, 90, http://www.bits.de/NRANEU/others/END-Archive/AFDD1(11).pdf.)

JFACC - joint force air component commander
JFLCC - joint force land component commander
JFMCC - joint force maritime component commander
JFSOCC - joint force special operations component commander
COMAFFOR - commander, Air Force forces
COMARFOR - commander, Army forces
COMNAVFOR - commander, Navy forces
COMMARFOR - commander, Marine Corps forces

Although the COMAFFOR and JFACC may be the same person, Air Force Instruction (AFI) 13-1, *Operational Procedures—Air Operations Center* (*AOC*), advocates the execution of responsibilities through separate staffs but then blurs and confuses the associated C2. The AFI articulates that the COMAFFOR should exercise operational and administrative control and that the JFACC should exercise tactical control. In the very next paragraph, however, the AFI states that "the AOC enables the JFACC to exercise operational-level C2 of air and space forces."[4] The AFI clearly contradicts itself and creates confusion. This confusion is amplified in AOC AFI guidance noting that "C-NAF [component numbered air force] headquarters will be properly structured, equipped, manned, and trained to execute C2 of air, space, and cyberspace operations assigned or attached to the unified component commander (UCC)

for day-to-day operations with the ability to accept additional AOC forces for any increase in UCC mission tasking or direction. A C-NAF will normally look as shown" in figure 3.[5] As depicted and in practice, the C-NAF commander effectively has a split headquarters—AOC and AFFOR—with roles and responsibilities defined in separate AFIs increasing the potential for gaps and seams in the C2 of air, space, and cyberspace operations.

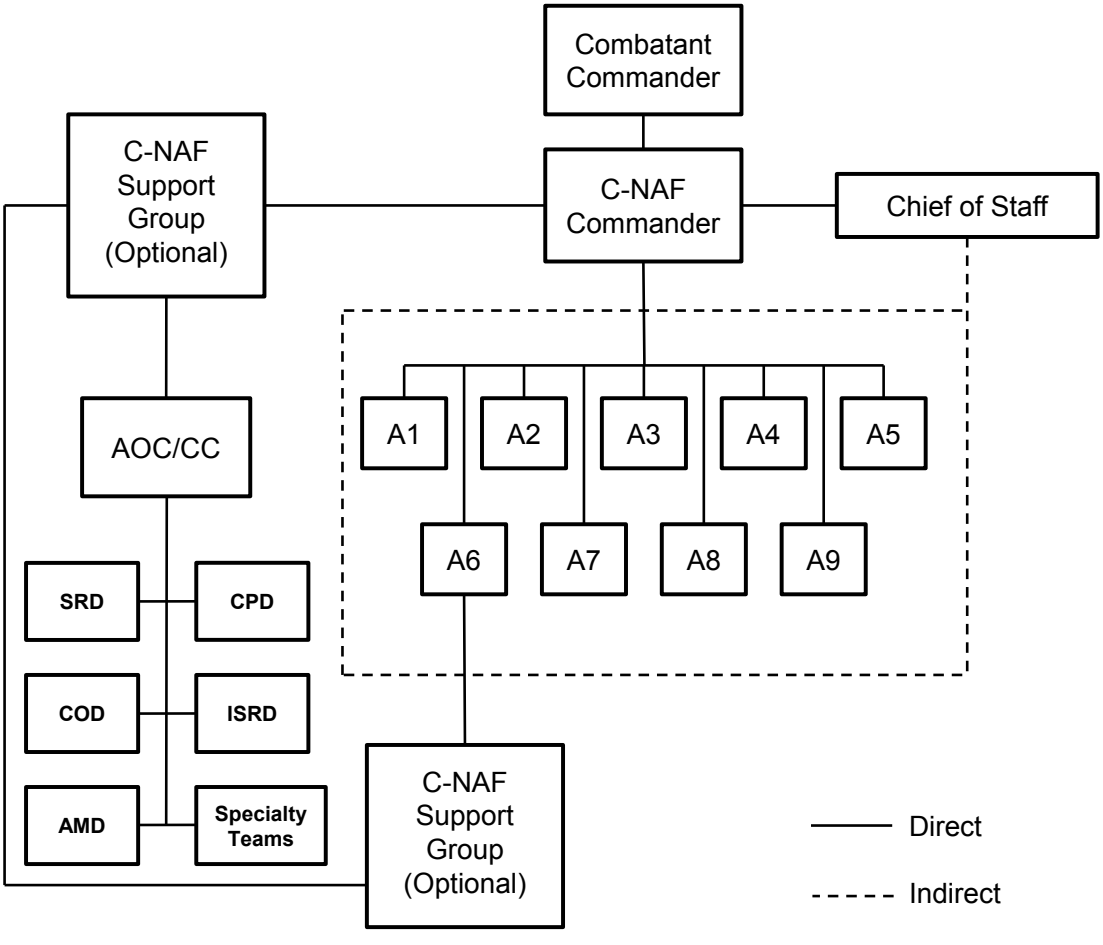

Figure 3. Current air component framework. (Adapted from Air Force Instruction 13-1AOC, vol. 3, *Operational Procedures—Air Operations Center [AOC]*, 2 November 2011 [incorporating change 1, 18 May 2012], 12, http://static.e-publishing.af.mil/production/1/af_a3_5/publication/afi13-1aocv3/afi13-1aocv3.pdf.)

C-NAF - component numbered air force
AOC/CC - commander, air operations center
A1 - manpower, personnel, and services
A2 - intelligence, surveillance, and reconnaissance (ISR)
A3 - operations
A4 - logistics

A5 - plans and requirements
A6 - communications
A7 - mission support and installations
A8 - strategic plans and programs
A9 - studies, analyses, assessments, and lessons learned
SRD - strategy division
CPD - combat plans division
COD - combat operations division
ISRD - ISR division
AMD - air mobility division

Room for Improvement

Due to the AFI guidance and past doctrinal mindsets that shaped the air component organizational construct, COCOMs, joint, and coalition partners do not clearly understand the distinction between the AFFOR and AOC. This misunderstanding is not limited to our joint and coalition partners, however. A survey across the Air Force would likely reveal that Airmen as well do not fully understand the defined doctrinal and AFI roles between the AFFOR and AOC. The lack of comprehension is likely not a surprise. Within the air component today, the lines of responsibilities between AOC and AFFOR operational elements in planning, coordination, and execution are often blurred and overlapping, resulting in misunderstanding and inefficiencies.

With the November 2014 doctrine update, the Air Force made great strides to correct some of the more problematic doctrinal concepts. Air Force doctrine now opens the door to address inefficiencies inherent in the current air component construct. Doctrine now reflects historical practice and provides a framework in which the COMAFFOR can expect to be dual-hatted as the JFACC and execute C2 through an AFFOR and AOC.[6] As a result, the AOC can now easily evolve to be a joint or combined AOC, which should allow for better integration of joint and coalition partners into the air component.[7] Additionally, doctrine stresses that the AFFOR and AOC should develop a habitual working relationship as a way to overcome problems that arise from the split staff.[8]

Despite the maturation of Air Force C2 doctrine, redundancies and inefficiencies persist within the updated framework. Although the COMAFFOR is

As a component major command (C-MAJCOM) operations director (AFFOR/A3), I and my AFFOR/A3 staff had constant interaction with COCOM J3s in the planning of future operations; however, in execution of the same operation or in a crisis, I was unable to provide real-time information when queried by the COCOM J3 or component 3s. I often found myself redirecting inquiries to the AOC (or air component deputy) versus being responsive to the COCOM J3.

I found a similar situation during my time as the DCFACC. I had more situational awareness and engagement with the US Central Command J3 and component 3s on both future and current operations than the air component operations director.

—Lt Gen CQ Brown Jr.

I had the same experience at the lower levels of coordination. As a deputy air component coordination element, I often found that there was no clearly defined separation between AOC and AFFOR responsibilities. The end result was confusion over problem ownership. During my time in the combined air operations center (CAOC) working closely with a combined joint task force J-35 staff, there was often confusion on the proper point of contact in the air component.

—Lt Col Rick Fournier

responsible for determining the size, shape, and location of the AFFOR staff and AOC to best support the operation, the admonition against dual-hatted staff positions remains, frequently resulting in overlap of work or, worse, creating a gap.[9] Within the AFFOR, the A3 is "the principal staff assistant . . . in the direction and control of all assigned and attached Air Force forces" and is the "focal point for executing component operations outside the purview of the AOC."[10] Similarly, the AOC "is the Air Force component commander's command and control (C2) center that provides the capability to plan, direct, and assess the activities of assigned and attached forces."[11] Although not specifically stated in either doctrine or AFIs, the air component effectively places current operations within the AOC and future operations within the AFFOR/A3. Both staffs are tasked with planning, directing, and controlling assigned and attached forces without clear delineation of responsibilities in either doctrine or AFI guidance. As previously stated, this overlap causes confusion and some duplicative work at best. More concerning is a potential gap or lack of responsiveness that could negatively affect an operational outcome.

The confusion and inefficiency are not limited to inside the air component, though. The assumed line between current operations (AOC) and future operations (A3) potentially creates a seam in planning and execution in relation to COCOMs and sister components. This seam creates confusion between the joint organizations that the AFFOR and AOC staffs interact with on a daily basis. COCOM and component operations directorates (J3, G3, N3) are responsible for both current and future operations. In COCOM staffs and joint task forces, the component operations centers work directly for the operations directorate—the air component is the *outlier*. The AOC is aligned outside the AFFOR/A3 staff, creating a separate and somewhat illusory entity. As a result, when a joint staff interacts with the air component, there is often confusion over whom to contact—the A3 staff or the AOC. From experience, COCOM and component operations directors tend to engage more often with the air component deputy (or CAOC director if assigned) versus engaging the air component operations director (AFFOR/A3). With the current air component construct, the air component deputy is effectively the lowest level for oversight and integration of current and future operations. Similar oversight and integration happens at a lower level within joint and component staffs—specifically, at the operations director level.

To gain synergy with other components and joint staffs and to reduce the existing seams and/or gaps, the AOC as an "operations center"—an extremely capable "operations center"—can and should be aligned under the operations directorate. Although generally accepted practices in execution do exist, the AOC and AFFOR AFIs are not particularly clear in articulating the dividing line between responsibilities that are inside and outside the purview of the AOC. Given this background of similar responsibilities and the desired habitual relationship, why not align the A3 and AOC into a more synergistic organizational construct similar to joint doctrine and aligned with the rest of the joint community?[12]

Proposed Framework

Manning the AOC and AFFOR under this new construct will require an integrated and agile approach. Air components are not typically manned for contingency operations above and beyond steady-state phase zero operations. As such, in the early stages of any contingency, air component Airmen require the basic capability and flexibility to operate in the AOC or AFFOR to fill immediate, critical requirements. Whether working as a member of A3 coordinating the needed air assets for the theater one day or working in the AOC to develop the air tasking order to employ those assets the next, flexibility is the key. As a contingency progresses beyond steady-state phase zero, additional manning requirements would likely be sourced, allowing AOC and AFFOR Airmen to return to their normal AOC or AFFOR duties. Consequently, there must be an executable process to ramp up manning from phase zero to phase three and back down when the contingency is over.

To achieve this operational flexibility, the Air Force will need to modify the current training system for AFFOR and AOC personnel. All Airmen working on either staff should have core air component training and then receive additional specialized AOC or AFFOR training as necessary. This does not dissolve the concept of the AOC as a weapons system. A difference exists between the AOC weapons system and the AOC organization: the AOC weapons system is analogous to any Air Force major weapons system that requires funding, logistical support, and personnel to allow employment as an operational unit.[13]

Realignment of the AOC within the A3 would not result in major changes to the organizational structure. This structure would work in Falconer AOCs that reside in either a C-NAF or C-MAJCOM construct. However, regardless of whether this construct is at a C-NAF or C-MAJCOM, the traditional AFFOR functions must continue. In any case, the AOC will remain an entity with five divisions—just as it exists today. Nevertheless, the following minor changes will occur within the AOC to better align the air component with the joint force:

The air operations center commander (AOC/CC) can be dual-hatted as the AFFOR A3:

- Dual-hatting of the AOC/CC and A3 has occurred in the past when a single officer served as both director of operations, CAOC; and director of operations, Central Command Air Forces Forward.
- This arrangement is best suited for AOCs where the A3 and the AOC/CC positions are of equal rank. In a C-MAJCOM, in which the A3 is a usually a general officer, the AOC/CC would work directly for the A3.
- The AOC/CC would remain a Command Screening Board position.

Within the proposed air component structure, special staff functions should not be duplicated in the AOC and AFFOR but should be complementary and integrated.[14] The five divisions in the AOC would still exist, receiving direct support from other staff components as necessary. The AOC functions would remain the same, but the naming convention would be modeled on a typical joint staff framework:

- The A30 will provide traditional AFFOR functions for the A3.
- The A32 intelligence, surveillance, and reconnaissance division (ISRD) will receive direct support from the AFFOR A2. The ISRD houses traditional intelligence functions, which will benefit from direct support from the A2 staff.
- The A33 combat operations division (COD) and A35 combat plans division (CPD) will receive direct support from the A3.
  - The A33 COD closely aligns with the operations centers traditionally located at a joint or task force staff.
  - The A35 CPD focuses on the next 72 hours and therefore falls within the time frame of a traditional J35 staff looking at near-term future operations.
- The A34 air mobility division will receive direct support from the A3 as well but will also continue to receive assistance from the director of mobility forces "to ensure the effective integration of intertheater and intratheater air mobility operations, and [facilitate] intratheater air mobility operations."[15]
- The A37 strategy division (SRD) will receive direct support from the AFFOR A5 while supporting A3 operations. The A37 SRD occupies a unique position, straddling what would traditionally be a J35 staff with future operations responsibilities and a J5 staff with strategy and future plans responsibilities. Within the A37 SRD, the strategy guidance branch leans towards the former with their 96-hour outlook, and the strategy plans branch aligns with the latter, looking outside five days. The operational assessments branch aligns with staff functions located within a typical J5 staff.

The Way Ahead

Historically, the air component has been an *outlier*. The recent change in doctrine allows the Air Force to seize the opportunity and make the air component more effective. The AOC within the A3 is neither a unique nor a new concept. Counter to AFI guidance and previous Air Force doctrine, the concept of incorporating the AOC within the A3 has been employed in different forms. Whether in the past, during exercises, or in the current drive to gain staff-manpower efficiencies, the AOC within the A3 construct has proven to have merit. Building on recent doctrine changes, an opportunity presents itself to update the air component structure and the associated AFIs and training to better employ air, space, and cyber capabilities for the combatant commander in the joint fight. We can maintain the status quo where the air component remains an outlier with self-induced operational gaps and seams between the AOC and A3, or we can seize the opportunity *to become an air component with a staff and operations center versus a staff and operations center that is an air component. We must have the presence of mind to do so.* ✪

Notes

1. Lt Col Joseph H. Justice III, "Airpower Command and Control: Evolution of the Air and Space Operations Center as a Weapon System," research paper (Carlisle Barracks, PA: US Army War College, 2004), http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ada423705.
2. Joint Publication (JP) 3-30, *Command and Control of Joint Air Operations*, 10 February 2014, II-2, http://www.dtic.mil/doctrine/new_pubs/jp3_30.pdf.
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5. Ibid., 11.
6. Curtis E. LeMay Center for Doctrine Development and Education, "Command and Control Mechanisms," in "Annex 3-30, Command and Control," 7 November 2014, 41, https://doctrine.af.mil/download.jsp?filename=3-30-Annex-COMMAND-CONTROL.pdf.
7. Curtis E. LeMay Center for Doctrine Development and Education, "Air Operations Center," in "Annex 3-30, Command and Control," 42–43.
8. Curtis E. LeMay Center for Doctrine Development and Education, "Air Force Forces (AFFOR) Staff," in "Annex 3-30, Command and Control," 44–45.
9. Ibid.
10. Curtis E. LeMay Center for Doctrine Development and Education, "Appendix C: The Air Force Forces (AFFOR) Staff," in "Annex 3-30, Command and Control," 107.
11. Curtis E. LeMay Center for Doctrine Development and Education, "Air Operations Center," in "Annex 3-30, Command and Control," 42.
12. JP 3-0, *Joint Operations*, 11 August 2011, IV-10, http://www.dtic.mil/doctrine/new_pubs/jp3_0.pdf.
13. AFI 13-1AOC, vol. 3, *Operational Procedures—Air Operations Center* (*AOC*), 5, par. 1.1.
14. JP 3-30, *Command and Control of Joint Air Operations*, E-3.
15. Ibid., III-28.

Lt Gen CQ Brown Jr., USAF

Lieutenant General Brown (BS, Texas Tech University; MSA, Embry-Riddle Aeronautical University) is commander, US Air Forces Central Command, Southwest Asia. As the air component commander for US Central Command, the general is responsible for developing contingency plans and conducting air operations in a 20-nation area of responsibility covering Central and Southwest Asia. General Brown was commissioned in 1984 as a distinguished graduate of the ROTC program at Texas Tech University. He has served in a variety of positions at the squadron and wing levels, including an assignment to the US Air Force Weapons School as an F-16 instructor. His notable staff tours include aide-de-camp to the chief of staff of the Air Force; director, Secretary of the Air Force and Chief of Staff Executive Action Group; and deputy director of operations, US Central Command. He also served as a National Defense Fellow at the Institute for Defense Analyses, Alexandria, Virginia. General Brown has commanded a fighter squadron, the US Air Force Weapons School, and two fighter wings. Prior to his current assignment, he served as director of operations, strategic deterrence, and nuclear integration, Headquarters US Air Forces in Europe—Air Forces Africa, Ramstein Air Base, Germany. The general is a command pilot with more than 2,890 flying hours, including 95 combat hours.

Lt Col Rick Fournier, USAF

Lieutenant Colonel Fournier (BS, Texas A&M University; MS, Texas Tech University; MMAS, School of Advanced Military Studies) is currently deployed as the chief, Strategy Plans, 609th Air Operations Center. He is stationed at Langley AFB, Virginia, as chief, Wargaming and Concepts Branch, Directorate of Plans, Programs, and Requirements, Air Combat Command. Lieutenant Colonel Fournier was commissioned in 1998 from the ROTC program at Texas A&M University. He has served in a variety of positions at the squadron and wing levels, including chief, Group Standardization and Evaluation, and wing executive officer. He has also served as an air liaison officer at Fort Hood Army Installation, Texas. Lieutenant Colonel Fournier is a B-1B instructor pilot with 1,550 hours, including 429 combat hours.

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Challenging Minimum Deterrence

Articulating the Contemporary Relevance of Nuclear Weapons

Maj Joshua D. Wiitala, USAF*

*I would like to thank Dr. Mel Deaile, Maj Brian Styles, and Maj Scott Hughes for their insightful reviews of this article.

Since the end of the Cold War, the enduring relevance of nuclear weapons has been the subject of immense debate with policy analysts proposing several alternative nuclear postures meant to address the evolving geopolitical circumstances of the United States. These range from the extreme positions of complete nuclear abolition to a renewed interest in war-fighting roles for US nuclear weapons. The current need to initiate recapitalization programs for key elements of the US nuclear force gives this debate added meaning and urgency. One alternative currently under discussion is minimum deterrence. This article evaluates minimum deterrence as an alternative nuclear posture for the United States and introduces "dual deterrence" as a more suitable framework for understanding the contemporary relevance of US nuclear weapons.

Understanding Minimum Deterrence

In his classic work *Strategy in the Missile Age*, Bernard Brodie argues that nuclear weapons have changed traditional conceptions of war and that political and military leaders must adapt to these fundamental changes. For Brodie, one traditional concept that altered dramatically was deterrence. Prior to the advent of nuclear weapons, he contends that deterrence was a very "dynamic" concept that "acquired relevance and strength from its failures as well as its successes." In the nuclear age, however, he argues that deterrence is effective only as a more static concept that unambiguously guarantees effective use of overwhelming force at any given moment. Consequently, deterrence is now underpinned by a potentially devastating "retaliatory instrument" that is constantly at the ready but perpetually unused. Brodie concludes that this strategic situation gives deterrence an almost "unreal" quality in the nuclear age with a fundamental problem of credibility.[1] For him, this issue of credibility is central to understanding and defining the concept of minimum deterrence.

Brodie expounds on this issue by asserting that minimum deterrence begins with an understanding of "basic deterrence." From the perspective of the United States, basic deterrence is "deterrence of direct, strategic, nuclear attack upon targets within the home territories of the United States."[2] For Brodie, basic deterrence does not have the same credibility problem that other uses of nuclear weapons may have because no one doubts that the United States, or any other state for that matter, would use all of the means at its disposal to respond to an overwhelming nuclear attack from another state. Thus, in the context of basic deterrence, the destructive potential of nuclear weapons can be *credibly* optimized in terms of national defense policy. The implications of this destructive potential bring about a fundamental change in the efficacy of deterrence. In the past, it was closely linked to the relative strength of opposing military forces. Brodie concludes that, in the nuclear age, "the potential deterrence value of an admittedly inferior force may be sharply greater than it has ever been before."[3] As the following discussion illustrates, this logic concerning the increased value of a small but effective force is central to the concept of minimum deterrence.

In essence, minimum deterrence simply argues that a small but secure nuclear retaliatory force can effectively threaten unacceptable damage to one's adversary and thus deter him from threatening the existence of the deterring state. According to this reasoning, a nuclear posture scaled and designed to "win the war" against a potential adversary's forces and economic infrastructure represents a fundamental misunderstanding of what nuclear weapons actually mean to interstate relations.[4] Here, the arguments of modern advocates for minimum deterrence come into play. In a 2010 article advocating minimum deterrence, a group of US Air Force scholars and officers (James Wood Forsyth, Col B. Chance Saltzman, and Gary Shaub Jr.) adopt the view that nuclear weapons are fundamentally political in nature.[5] They maintain that nuclear weapons are not suited to war fighting and are useful only as a guarantor of the basic security of a given state. However, they advocate a slightly different basis for minimum deterrence than the classic foundation laid by Brodie.

Although Brodie based minimum deterrence on the foundation of basic deterrence (termed "existential deterrence" by Forsyth, Saltzman, and Shaub), today's

advocates of minimum deterrence offer "proportional deterrence" as a theoretical bedrock for understanding minimum deterrence as a policy.[6] Proportional deterrence asserts that deterrent forces must be scaled to inflict costs on an adversary that exceed the potential gains involved in either a large-scale nuclear attack or conventional invasion. Instead of simply threatening massive damage on a foe, proportional deterrence seeks to specifically communicate to adversaries that such destruction will quantitatively and qualitatively cancel any possible gains.[7] This modern iteration of minimum deterrence shares a basic conceptual continuity with Brodie's depiction in that it hinges on the willingness of the deterring state to hold the "aggressor's population/industrial centers" at risk.[8] Advocates of minimum deterrence describe this view as a "*countervalue*" approach that involves punishing one's adversary versus a "*counterforce*" approach that focuses on targeting an adversary's military in order to deny its wartime objectives.[9] This commitment to a countervalue approach is one of the key facets of minimum deterrence that has traditionally made it unappealing to US policy makers. Such an aversion to countervalue targeting, however, has not always been a part of US policy.

At the beginning of the nuclear age, US war plans were largely countervalue in nature and called for the decimation of Soviet cities in response to a Soviet invasion of Western Europe. Initial plans made in 1946, for example, called for the destruction of "20 urban targets in the Soviet Union."[10] By 1949 the list had grown to include "70 urban and industrial centers."[11] These targets were certainly chosen for their ability to support the Soviet capacity to wage war, but, from a deterrence standpoint, they were clearly countervalue. Throughout the 1950s, the explicit policy of "massive retaliation" largely embraced countervalue targeting as a central component of US deterrence logic and military planning.[12] By the early 1960s, however, the focus began to change as overall US policy progressed toward the Kennedy administration's "flexible response." Secretary of Defense Robert McNamara articulated this shift unambiguously in a 1962 speech to the North Atlantic Treaty Organization (NATO) in which he stated that "principal military objectives, in the event of a nuclear war stemming from a major attack on the Alliance, should be the destruction of the enemy's military forces, not of his civilian population."[13] Policy has certainly evolved immensely since the 1960s, but this conceptual commitment to a counterforce approach endures to this day.

The "Report on Nuclear Employment Strategy of the United States," issued in 2013 by the Department of Defense in response to the 2010 *Nuclear Posture Review Report*, clearly illustrates this point. It observes that the "new guidance requires the United States to maintain significant counterforce capabilities against potential adversaries," concluding unequivocally that US policy "does not rely on a 'countervalue' or 'minimum deterrence' strategy." Instead, the report insists that the United States must be able to "achieve U.S. and Allied objectives if deterrence fails." It clarifies how America plans to achieve these objectives, noting unambiguously that "the United States will not intentionally target civilian populations or civilian objects."[14] Thus, minimum deterrence, as defined by its modern proponents, would represent a significant conceptual change from the historic and contemporary nuclear postures of the United States.

Why Minimum Deterrence?

Proponents of minimum deterrence, however, argue not only that such a change is warranted by current circumstances but also that it ultimately reflects the true nature of nuclear weapons in interstate relations, whether US policy makers recognize this fact or not. In this view, the United States does not change the fundamental role of nuclear weapons in international relations by having a large and diverse arsenal. Instead, it simply overspends on nuclear weapons, failing to realize that the true significance of a nuclear arsenal lies in the narrow political utility outlined by the tenets of minimum deterrence.

To illustrate this point, supporters of minimum deterrence offer several examples. First, they cite the French nuclear arsenal as evidence that France can effectively secure its own defense by sizing its arsenal so that it can inflict proportional damage on a foe. Second, they discuss the relationship of China and the United States, observing that China has "about 200 operationally deployed" nuclear weapons. According to advocates of minimum deterrence, this arsenal represents the results of a "minimum deterrent strategy" designed to be capable of "destroy[ing] more than the value of Taiwan to the United States." Given that Taiwan is "the most likely stakes [*sic*] in any conflict between the two countries," they conclude that China's minimum deterrence strategy effectively holds the much larger US arsenal at bay. Third, proponents offer the historical argument that "both sides were, in fact, deterred fairly early on during the Cold War" and that the massive buildup of nuclear arms misunderstood then, as it does now, the fundamental role of nuclear weapons in international relations.[15]

From all of the foregoing, champions of minimum deterrence conclude that nuclear weapons' ability to inflict massive damage on a given state causes "statesmen to act with restraint."[16] Inducing this restraint, according to minimum deterrence, represents the true effect of these weapons on interstate relations and should be the goal of a nuclear posture. According to advocates of minimum deterrence, one can achieve the latter with a relatively small arsenal since, ultimately, the destructive potential of nuclear weapons is relevant, not a state's espousing a "countervalue or counterforce targeting" philosophy during times of peace.[17]

A "Minimum" Force Structure

Today the US strategic arsenal is capped by the New Strategic Arms Reduction Treaty (START) that entered into force in 2011. It limits the United States to "1,550 accountable strategic warheads, 700 deployed strategic delivery vehicles, and a combined limit of 800 deployed and non-deployed strategic launchers." Additionally, the United States maintains a stockpile of "non-deployed nuclear weapons" as well as a small arsenal of "non-strategic nuclear weapons" deployed in Europe.[18] Forsyth, Saltzman, and Shaub contend that this arsenal could be reduced to a mere "311 nuclear weapons" yet still "address military utility concerns" and sustain "a stable deterrence."[19] This trimmed-down arsenal would consist of 100 intercontinental ballistic missiles (ICBM) equipped with a single warhead each and 192 submarine-launched ballistic missiles (SLBM) equipped with one warhead each and loaded aboard a fleet

of eight deployed *Ohio*-class submarines. The remainder of the weapons would be available for use on B-2 bombers.[20] This hypothetical arsenal represents a greater than 90 percent reduction of the current one and would firmly commit the United States to the logic of minimum deterrence. [21] According to minimum-deterrence advocates, it would also be diverse and reliable enough to ensure that the "vital ingredients of nuclear deterrence" such as "readiness, survivability, and flexibility" remain resident within the nuclear posture of the United States.[22]

In light of their commitment to these traditional aspects of nuclear deterrence, it seems that modern proponents of minimum deterrence do not propose any drastic changes to the alert posture of US nuclear forces, even as they seek to alter its structure dramatically. Additionally, their recommendation of 311 warheads is not intended to represent the only arsenal that could operationalize the concept of minimum deterrence. Similar plans with slightly different numbers could also meet their intent. Nonetheless, supporters of minimum deterrence assert that anything less than drastic reductions represents a fundamental misunderstanding of the true impact of nuclear weapons on interstate affairs.[23]

Challenging Minimum Deterrence

Having described minimum deterrence as a concept and explored its potential implications as a posture, this article devotes the next two sections to evaluating whether or not it can truly account for the specific geopolitical context of the United States, beginning with a short account of why America did not implement minimum deterrence during the Cold War. In the late 1950s, Brodie saw four immediate ways in which minimum deterrence failed to account for the Cold War geopolitical context of the United States. First, he asserts that "a large force" may be required to ensure "even a modest retaliation." Second, he argues that deterrence forces must be formidable enough to account for the "generally high degree of motivation which the enemy feels for our destruction." Third, Brodie rejects the fundamental claim of minimum deterrence that nuclear weapons are relevant only as political weapons by stating that "if deterrence fails we shall want enough forces to fight a total war effectively." Finally, he insists that the nuclear arsenal of the United States be built to keep open the option of a first strike. That is, it must be sized to make such an opening attack "overwhelming to the enemy's retaliatory force."[24]

Today, Brodie's rationale for doubting minimum deterrence maintains varying levels of contemporary relevance. His assertion that a large arsenal is required to guarantee a retaliatory capability is mitigated by the resiliency of today's nuclear triad, something that Brodie had only begun to foresee in the late 1950s.[25] Modern advocates of minimum deterrence understand this point and consequently highlight the survivability and diversity of even small nuclear forces that consist of long-endurance nuclear submarines, mobile land-based missile systems (although the United States does not currently deploy these), and versatile nuclear-capable bombers. Brodie's second concern is a point of much contemporary debate. During the Cold War, the Soviet threat made it easy to perceive of an adversary willing to go to great

lengths to defeat the United States. Today, however, US policy reflects the broad consensus that "the threat of global nuclear war has become remote."[26] Therefore, contemporary arguments about an adversary's motivations in the context of nuclear war are largely grounded in the compelling but less immediate notion of continued geopolitical uncertainty (a point strengthened over the last two years by Russian misbehavior in Europe). This broad argument, however, is more effective in asserting the need to preserve a nuclear capability at all versus favoring a specific type of nuclear posture.

Next, for two reasons, Brodie's concern over the need to preserve a potent first-strike capability as a viable policy option is much less compelling today than it was in the early days of the Cold War. First, the United States now enjoys a conventional superiority that it did not have during the Cold War and would benefit in most foreseeable scenarios from keeping a conflict conventional. Second, as Brodie later notes, strategic stability with another major nuclear power rests in large part on the ability of two potential adversaries to field a secure second-strike capability.[27] One would be hard pressed today to promote an offensive capability aimed at upsetting that stability.[28] Brodie's concern over what to do if deterrence fails, though, remains immensely relevant and leads us to consider what a similar list of concerns might look like from the standpoint of today's geopolitical context.

The current US strategic situation presents three specific challenges to the perspective of minimum deterrence. The first is embodied in Brodie's question about what to do if deterrence fails. He asserts, in accordance with the logic of minimum deterrence, that holding an enemy's cities at risk in times of peace initially seems to be the obvious way to maximize "deterrent effect." However, he observes that "the rub comes from the fact that what looks like the most rational *deterrence* policy involves commitment to a strategy of response which, if we ever had to execute it, might then look very foolish. The strategy of deterrence ought always to envisage the possibility of deterrence failing" (emphasis in original).[29] *In short, a fundamental problem with minimum deterrence is that a purely countervalue retaliatory attack gains the defender no advantage, defensive or offensive, during an actual exchange*. Specifically, because minimum deterrence does not give the defender a counterforce (denial) option for destroying an enemy's capacity to fight, it thus potentially leaves the original belligerent in a position to continue seeking his war aims. A countervalue (punishment) strike could certainly kill large numbers of civilians but would not necessarily decimate the near-term military capacity of a given foe and inevitably lead to the termination of a particular war.

Lawrence Freedman addresses this logic in his book *Deterrence*, writing that "in principle, denial is a more reliable strategy than punishment because, if the threats have to be implemented, it offers control rather than continuing coercion. With punishment, the target is left to decide how much more to take. With denial the choice is removed."[30] For Freedman, contextual factors ultimately could make a countervalue strategy more appealing to a certain actor, but from a conceptual standpoint, denial is clearly the preferable option. Additionally, one should emphasize that minimum deterrence assumes a countervalue response even if a nation's own cities are spared during a large-scale counterforce attack. That is, a retaliatory

response could actually provoke a second strike on previously untouched cities within one's own territory.[31]

For advocates of minimum deterrence, however, the need to maintain a counterforce capability against another great power—Russia, specifically—to address this conceptual shortcoming is less than compelling. Minimum-deterrence advocates state explicitly that holding Russian cities at risk is enough to deter a larger Russian arsenal.[32] This thinking seems to represent an extension of Kenneth Waltz's realist take on deterrence relationships. He writes that "to ask why a country should carry out its deterrent threat if deterrence fails is to ask the wrong question." Instead, Waltz believes that any threat of a strong response is enough to deter a would-be attacker in the nuclear era because "uncertainty of response, not certainty, is required for deterrence," given the fact that "if retaliation occurs, one risks losing so much."[33]

Ultimately, Waltz's point is a compelling argument in favor of the logic of minimum deterrence on this matter since it seems to address the underlying issue of credibility. However, his contention cannot overcome the fundamental fact that minimum deterrence would commit the United States to taking militarily useless and potentially counterproductive actions with enormous moral repercussions should deterrence fail.[34] In his recently published book on the history of nuclear weapons, Eric Schlosser sums up this fundamental shortcoming well: "The problems with a strategy of minimum deterrence have changed little in the past fifty years. It cannot defend the United States against an impending attack. It can only kill millions of enemy civilians after the United States has already been attacked."[35] Clearly, this is not an acceptable basis for US policy, given that the United States is capable of fielding a viable counterforce deterrent. Although one should acknowledge that no large-scale targeting scheme could ever be purely counterforce or purely countervalue, the distinction between the two extremes is nonetheless more than just academic. It is intensely practical because the focus of one's targeting scheme would have immense consequences in terms of civilian casualties and overall levels of civil destruction should a large-scale nuclear exchange ever occur.

The second challenge to a posture of minimum deterrence is its failure to account for the prospect of the limited use of nuclear weapons in an otherwise conventional war. As noted above, the United States enjoys conventional superiority today in most foreseeable scenarios. This superiority raises the potential value of nuclear weapons to US adversaries who may see them as a way of counterbalancing US strengths. Keir Lieber and Daryl Press assert that "if U.S. military forces begin to prevail on the battlefield, US adversaries may use nuclear threats to compel a cease-fire or deny the United States access to allied military bases." They add that "such threats might succeed in pressuring the United States to settle the conflict short of a decisive victory." They observe that this adversary strategy should not be regarded as "far-fetched" since "it was NATO's policy during much of the Cold War" when alliance forces were vastly outnumbered by those of the Warsaw Pact. Instead, they conclude that "a central strategic puzzle of modern war is that the tactics best suited to dominating the conventional battlefield are the same ones most likely to trigger nuclear escalation."[36] This role of nuclear weapons is not adequately accounted for by minimum deterrence because it fails as a policy to fully

envision the relevance of nuclear weapons to relatively weak states that may believe a limited war with the United States is in their interests.

Lieber and Press see the solution to this potential scenario in a diverse nuclear arsenal with three specific attributes. The first is the maintenance of "some high-yield nuclear weapons." In this regard, they agree with advocates of minimum deterrence that these weapons are still important for existential threats, and they further agree that the number of these weapons could be reduced beyond current levels. The second attribute is "conventional counterforce weapons."[37] This recommendation also coincides with the arguments of today's minimum-deterrence advocates in that it emphasizes the ability of modern precision weaponry to counter some of the nuclear capabilities of less sophisticated adversaries.[38] The final attribute is an arsenal of low-yield nuclear weapons with improved accuracy.[39] At this point, Lieber and Press diverge sharply from the minimum-deterrence perspective, asserting that such weapons are needed to deter the limited use of nuclear weapons and concluding that "a credible deterrent must give U.S. leaders acceptable options in the event an enemy were to use nuclear weapons. An arsenal that can only destroy cities fails that test."[40] One should note that during the second Bush administration, this logic underpinned research into "precision, low-yield weapons that would inflict a much lower level of civilian casualties" and thus act as a more effective deterrent to nuclear escalation.[41]

Finally, it is important to understand that Lieber and Press's concerns about the role of limited nuclear strikes in otherwise conventional wars are not merely conceptual. Instead, they are readily apparent in open-source accounts of recent Russian strategic planning. Russian scholar Yury Fedorov argues that "nuclear weapons are seen as the only means to compensate for the growing gap in nonnuclear forces between Russia and technologically advanced countries, especially the United States." He points out that this concern has generated a theory of "nuclear de-escalation." This theory posits that the "first limited use of nuclear weapons would not automatically escalate to a large-scale nuclear war" but that it might "convince" an adversary state "that using conventional military force (precise air and missile strikes) against Russia would be irrational." Fedorov notes that such "'nuclear deescalation' scenarios have been part of large-scale command and staff exercises in Russia since 1999."[42] This trend in Russia and elsewhere is something that minimum deterrence as a nuclear posture is ill prepared to confront. For Lieber and Press, this shortcoming of minimum deterrence is once again founded in a lack of credibility because "destroying cities would be a vastly disproportionate response if an enemy used nuclear weapons against a purely military target."[43]

The third challenge posed to minimum deterrence by the contemporary geopolitical context of the United States is extended deterrence. The 2010 *Nuclear Posture Review Report* describes extended deterrence as the provision of nuclear deterrence to US allies in order to deter regional aggression and keep them from feeling the need to proliferate with their own nuclear arsenals. This effort entails deploying limited numbers of nonstrategic nuclear weapons to NATO countries in Europe and maintaining the ability to forward-deploy nonstrategic and strategic nuclear weapons to the Asia-Pacific region in response to contingencies.[44] All of this is enabled by a diverse set of weapons and delivery systems within the current stockpile

that, in the near future, will include modernized B-61 nuclear bombs carried by stealthy F-35s and B-2s.[45]

Proponents of minimum deterrence, though, believe that extended deterrence is not in the interests of the United States. They urge US policy makers to step back from our alliance commitments and consider whether or not alliances in general are "useful."[46] This sweeping recommendation carries a litany of policy implications beyond the scope of this work.[47] However, on the limited topic of nuclear deterrence, the most immediate impact of removing the US nuclear umbrella would be the encouragement of proliferation by states friendly to the United States that would be left without a nuclear deterrent. Drawing again on the arguments of Waltz, minimum-deterrence advocates seem comfortable with this reality because, in their view, such a situation would force US allies to shoulder the burden of their own deterrence forces and would most likely generate regional stability similar to that experienced today between India and Pakistan.[48] To those who might lament the loss of stabilizing US influence and even control in these situations, Waltz offers two points relevant here. First, he states that nuclear proliferation does "not make nuclear war likely." Second, he declares that if weaker states do eventually use nuclear weapons in the course of war, "the world will not end." Instead, Waltz contends that "the use of nuclear weapons by lesser powers would hardly trigger their use elsewhere."[49]

Advocates of minimum deterrence make some important points about the potentially stabilizing effect of nuclear weapons in regional conflicts, but they ultimately fail to make a compelling argument as to why the United States should abandon the long-standing alliances that have served global stability and nonproliferation so well in the post–World War II era. Although it is true that further proliferation among US allies *may* fit into stable regional-security architectures, the provision by the United States of extended deterrence to its allies allows America to exercise important influence throughout the world and ultimately makes regional nuclear wars less likely. In doing so, the United States ensures that the weapons used to deter nuclear aggression against its allies utilize the strictest standards of nuclear surety. There is no guarantee that potential proliferators would also implement such stringent safeguards on their own arsenals.

Evaluating Minimum Deterrence

In sum, a posture of minimum deterrence allows some states to utilize nuclear weapons effectively in their most fundamental capacity. As long as a state can credibly threaten a massive countervalue strike in extreme scenarios, minimum deterrence can deter a large-scale nuclear attack and provide for a deterrent against other existential threats, including conventional invasion. If a particular state has no other strategic use for nuclear weapons, given its specific geopolitical context and overriding values, minimum deterrence may be both an effective and efficient nuclear posture. States such as China and India enjoy such a context and assume such a stance.[50] Others, however, see nuclear weapons as a way to balance out the conventional superiority of potential adversaries and thus envision a more expansive role

for them in their national policies. Broadly speaking, Russia and Pakistan are such states.[51] The geopolitical context of the United States, though, is unique in three important ways.

First, US policy is committed to maintaining counterforce retaliatory capabilities that effectively target a foe's military prowess should nuclear deterrence fail. This position differs significantly from what is often described as a "nuclear war-fighting strategy" and simply means that the United States has expressed a continuing aversion to targeting civilian population centers as a means of deterrence. This policy enhances credibility, provides national leaders with retaliatory options capable of denying an adversary's military objectives, and acknowledges the well-established US desire to minimize civilian casualties even in the most extreme scenarios. Second, the United States enjoys conventional superiority in most foreseeable contingencies; nevertheless, it has the need to deter the limited use of nuclear weapons by states that may seek to level the battlefield through a relatively discreet use of nuclear weapons. Finally, the United States has also committed to providing extended deterrence to its allies in a manner that assures security partners and discourages further proliferation. These contextual factors make a strict posture of minimum deterrence simply inadequate to the strategic needs of the United States.

Dual Deterrence

Instead, the geopolitical context of the United States requires a two-part nuclear posture that effectively addresses its strategic concerns and, in the process, provides an effective guide for the recapitalization of the US nuclear enterprise. This posture is *dual deterrence*, the first element of which is *existential deterrence*. The latter differs from the existential deterrence referenced by advocates of minimum deterrence in that it does not assume a countervalue targeting scheme based on a small number of survivable weapons.[52] Instead, existential deterrence simply denotes a force exclusively postured to deter threats to the sovereignty and survival of the United States through the credible threat of a large-scale counterforce retaliatory capability. This force would be reserved for the most extreme scenarios and would underwrite the independence and basic security of the United States. The existential deterrence force would consist of the ICBM and SLBM legs of the current triad and would require few, if any, changes to current force structure, alert postures, or command and control practices. However, some warhead and missile cuts *may* be feasible as military planners continue to assess the capabilities necessary to maintain a credible counterforce targeting scheme in an era when parity with another great power is no longer the driving factor in force levels. These potential cuts could yield valuable savings as both the ICBM and SLBM fleets face recapitalization expenditures over the next couple of decades.

This emphasis on the ICBM and SLBM legs as a constant existential deterrent does not mean, however, that the bomber leg of the triad would be irrelevant for ensuring US security and survival. Nuclear-capable bombers continue to play a role in deterring a large-scale nuclear exchange and can be postured appropriately in times of crisis. They also supply a critical technological hedge for the other legs of

the triad in the event that unforeseen vulnerabilities emerge in either capability. However, this role has evolved dramatically since the beginning of the nuclear era when bombers stood constant nuclear alert to deter the Soviet threat. Because bombers have not maintained continuous airborne alert since 1968 or continuous ground alert since 1991, it is time that we update our understanding of what this indispensable leg of the triad fundamentally offers the United States beyond its possible role in a doomsday scenario.[53]

This discussion leads us to the second element of dual deterrence: *escalation deterrence*, the purpose of which is simply to keep conventional wars conventional. It does so by deterring the limited use of nuclear weapons in otherwise conventional wars and by providing extended deterrence to critical US allies. It would be constituted in the near term by the Air Force's dual-capable bombers and fighters and would be maintained in the future by ensuring that the long-range strike bomber and the F-35 become nuclear capable. From a weapons perspective, this force would be enabled by the current weapons stockpile in the near term and sustained in the future by the modernization of B-61 gravity bombs and by procurement of the long-range standoff missile. Escalation deterrence should also keep the door open to further weapons development if current weapons are not deemed credible deterrents to any emerging capabilities or employment doctrines that potential adversaries may pursue.[54]

The strategic value of an escalation-deterrence force would be immense and would enhance the flexibility traditionally offered by the air-breathing leg of the triad. Not only would it effectively counter de-escalation theory by providing the scalable options advocated by Lieber and Press and reassure US allies by keeping the US nuclear umbrella credible, but also it would ensure that the United States maintains a flexible force capable of adaptive strategic messaging. In fact, even the term *escalation deterrence* would prove valuable because it would reinforce the significance of dual-capable aircraft's participation in key regional exercises as well as the purpose of bomber "presence" deployments around the world. The participation of B-2 and B-52 bombers in exercises over South Korea in 2013 illustrates this concept well.[55] In this sense, an escalation-deterrence force would supply the tools necessary for context-specific messaging or "tailored deterrence campaigns" during times of tension short of war.[56]

The organizational value of an escalation-deterrence force would also be immense for the US Air Force. It would provide focus for the dual-capable bomber and fighter fleets, enabling a fresh look at everything from nuclear training scenarios to critical command and control practices, all the while maintaining the sacred tenets of nuclear surety.

Conclusion

Ultimately, dual deterrence does not envision any revolutionary new uses for nuclear weapons, nor does it advocate sweeping changes to US force structures. It simply categorizes the contributions of the three legs of the triad in a manner that articulates their enduring relevance to potential adversaries, critical allies, and even the

US nuclear enterprise itself. It is a balanced posture that avoids the extremes of nuclear abolition and minimum deterrence on the one hand and a robust war-fighting role on the other. It broadly clarifies the potential roles of nuclear weapons yet does not eliminate useful strategic ambiguity or prevent the legs of the triad from reinforcing each other as a hedge for both technological and geopolitical uncertainty. Its purpose is simply to articulate the enduring value of nuclear weapons to the United States while minimizing the value of nuclear threats to potential adversaries across the spectrum of escalation. By doing so, dual deterrence offers a basic framework for approaching the much-needed recapitalization of the US nuclear enterprise. ✪

Notes

1. Bernard Brodie, *Strategy in the Missile Age* (Princeton, NJ: Princeton University Press, 1959), 272, 273.
2. Ibid., 273.
3. Ibid., 274–75.
4. Ibid., 276.
5. James Wood Forsyth, Col B. Chance Saltzman, and Gary Shaub Jr., "Remembrance of Things Past: The Enduring Value of Nuclear Weapons," *Strategic Studies Quarterly* 4, no. 1 (Spring 2010): 84.
6. Ibid., 78–79.
7. Ibid.
8. Ibid., 79.
9. Ibid., 76.
10. Phillip S. Meilinger, *Bomber: The Formation and Early Years of Strategic Air Command* (Maxwell AFB, AL: Air University Press, Air Force Research Institute, 2012), 104.
11. Ibid., 108.
12. Lawrence Freedman, *The Evolution of Nuclear Strategy*, 3rd ed. (New York: Palgrave Macmillan, 2003), 222.
13. Ibid., 223.
14. Department of Defense, "Report on Nuclear Employment Strategy of the United States Specified in Section 491 of 10 U.S.C." (Washington, DC: Office of the Secretary of Defense, June 2013), 4, 2, 5.
15. Forsyth, Saltzman, and Shaub, "Remembrance of Things Past," 78–79, 82.
16. Ibid., 80. For further elaboration of this argument, see James Forsyth's "The Common Sense of Small Nuclear Arsenals," *Strategic Studies Quarterly* 6, no. 2 (Summer 2012): 93–111.
17. Forsyth, Saltzman, and Shaub, "Remembrance of Things Past," 82; and James W. Forsyth, Col B. Chance Saltzman, and Gary Shaub Jr., "Minimum Deterrence and Its Critics," *Strategic Studies Quarterly* 4, no. 4 (Winter 2010): 5.
18. Department of Defense, *Nuclear Posture Review Report* (Washington, DC: Office of the Secretary of Defense, April 2010), ix, 27.
19. Forsyth, Saltzman, and Shaub, "Remembrance of Things Past," 82.
20. Forsyth, Saltzman, and Shaub, "Minimum Deterrence," 5–6.
21. Forsyth, Saltzman, and Shaub, "Remembrance of Things Past," 82.
22. Forsyth, Saltzman, and Shaub, "Minimum Deterrence," 5.
23. Ibid., 10.
24. Brodie, *Strategy in the Missile Age*, 277.
25. Ibid., 286.
26. Department of Defense, "Report on Nuclear Employment Strategy," 2.
27. Brodie, *Strategy in the Missile Age*, 303.
28. For an in-depth discussion on how the concept of stability through mutual vulnerability evolved during the Cold War and continues to influence nuclear policy today, see Keith B. Payne's *The Great American Gamble: Deterrence Theory and Practice from the Cold War to the Twenty-First Century* (Fairfax, VA: National Institute Press, 2008).
29. Brodie, *Strategy in the Missile Age*, 291, 292.

30. Lawrence Freedman, *Deterrence* (Cambridge, UK: Polity Press, 2004), 39.
31. Brodie, *Strategy in the Missile Age*, 292.
32. Forsyth, Saltzman, and Shaub, "Remembrance of Things Past," 83–84.
33. Scott D. Sagan and Kenneth N. Waltz, *The Spread of Nuclear Weapons: A Debate Renewed*, 2nd ed. (New York: W. W. Norton & Company, 2003), 24.
34. Although the moral shortcomings of a countervalue strategy are not the focus of this article, one cannot discuss this aspect of minimum deterrence without acknowledging the moral dimension involved in committing to a countervalue retaliatory targeting scheme.
35. Eric Schlosser, *Command and Control: Nuclear Weapons, the Damascus Accident, and the Illusion of Safety* (New York: Penguin Press, 2013), 484.
36. Keir A. Lieber and Daryl G. Press, "The Nukes We Need: Preserving the American Deterrent," *Foreign Affairs* 88, no. 6 (November/December 2009): 42, 43.
37. Ibid., 47, 48.
38. Forsyth, Saltzman, and Shaub, "Remembrance of Things Past," 83.
39. Lieber and Press, "Nukes We Need," 48.
40. Ibid., 44.
41. Roger Speed and Michael May, "Assessing the United States' Nuclear Posture," in *U.S. Nuclear Weapons Policy: Confronting Today's Threats*, ed. George Bunn and Christopher F. Chyba (Washington, DC: Brookings Institution Press, 2006), 265.
42. Yury Fedorov, "Russia: 'New' Inconsistent Nuclear Thinking and Policy," in *The Long Shadow: Nuclear Weapons and Security in 21st Century Asia*, ed. Muthiah Alagappa (Stanford, CA: Stanford University Press, 2008), 135, 148.
43. Lieber and Press, "Nukes We Need," 44.
44. Department of Defense, *Nuclear Posture Review Report*, 31–32.
45. Ibid., 34–35.
46. Forsyth, Saltzman, and Shaub, "Minimum Deterrence," 8.
47. These broad policy implications are best understood by reading James Forsyth's "The Past as Prologue: Realist Thought and the Future of American Security Policy," *Strategic Studies Quarterly* 5, no. 3 (Fall 2011): 102–20. In this work, Dr. Forsyth effectively lays out a broad vision for an American foreign policy that includes minimum deterrence within an overall realist framework.
48. Forsyth, Saltzman, and Shaub, "Remembrance of Things Past," 80–81.
49. Sagan and Waltz, *Spread of Nuclear Weapons*, 17.
50. National Security Advisory Board on Indian Nuclear Doctrine, "Draft Report of National Security Advisory Board on Indian Nuclear Doctrine" (New Delhi: Government of India Press, 17 August 1999), 2.
51. Charles E. Costanzo, "South Asia: Danger Ahead?," *Strategic Studies Quarterly* 5, no. 4 (Winter 2011): 101.
52. Forsyth, Saltzman, and Shaub, "Remembrance of Things Past," 78.
53. Scott D. Sagan, *The Limits of Safety: Organizations, Accidents, and Nuclear Weapons* (Princeton, NJ: Princeton University Press, 1993), 195; and Schlosser, *Command and Control,* 458.
54. One of the advantages of having an "escalation deterrence" force is that it would provide strategic context for assessing future weapons programs similar to the Bush-era Robust Nuclear Earth Penetrator program.
55. James A. Blackwell Jr. and Charles E. Costanzo, "Busting Myths about Nuclear Deterrence," *Strategic Studies Quarterly* 9, no. 1 (Spring 2015): 18.
56. Gen Kevin Chilton and Greg Weaver, "Waging Deterrence in the Twenty-First Century," *Strategic Studies Quarterly* 3, no. 1 (Spring 2009): 34.

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Just Checking the Box

Do Our Airmen Value Their CCAF Degree?

Maj Jason M. Newcomer, DBA, USAF
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MSgt Jason A. Fowler, USAF

A recent article, "CCAF Continues to Provide Value to Air Force, Enlisted Members," posted in the Community College of the Air Force (CCAF) alumni group on LinkedIn generated over 100 comments from CCAF graduates regarding the value of that college's degree.[1] Their perceptions of the worth of the CCAF degree ranged from no value at all to its having a tremendous impact on careers and goals.[2] The foregoing served as the catalyst for this two-phased research. Only by comparing both sides of the problem will we have truly answered the question regarding the value of the degree. Phase one consisted of the current research project, focused on the collection and analysis of CCAF graduates' perceptions regarding the value of their degree. Phase two will involve the collection of data collected from hiring

managers from various fields of industry regarding their perception of the CCAF degree and their estimation of it during a review of an applicant's credentials.

The CCAF Degree Program

The CCAF, an element of Air University, is a federally chartered two-year degree-granting institution accredited by the Southern Association of Colleges and Schools.[3] The college awards an associate of applied science (AAS) degree exclusively to enlisted military personnel after successful completion of a degree program based on their assigned Air Force specialty code (AFSC). The purpose of the college is to develop educated Airmen through giving them academic knowledge, practical skills, and a theoretical foundation for enhanced performance as technicians and military leaders.

Airmen begin earning credits towards their CCAF degree in basic military training. Upon graduation from their assigned AFSC technical training school, they earn credit to meet the college's technical education and program elective requirements. Once an Airman is assigned to a specific AFSC, that active duty, Air National Guard, or Air Force Reserve enlisted member is automatically admitted to the college and registered in the degree program that corresponds with his or her AFSC. The degree program includes aspects from the Airman's technical education offered by the Air Force's technical training schools, a core of general education from accredited civilian postsecondary education institutions, and management curriculum from Air Force or civilian sources. The CCAF AAS consists of a minimum of 64 credits:

- 24 credit hours in technical education, generally satisfied by courses at affiliated technical training schools and through skill-level upgrade internship;
- 6 credit hours in Leadership, Management, and Military Studies, preferably accomplished through Airman Leadership School, the Noncommissioned Officer (NCO) Academy and/or the Air Force Senior NCO Academy;
- 4 credit hours of physical education, satisfied by completing basic military training;
- 15 credit hours in general education, satisfied by transfer of credit from an accredited institution or college-level testing credit; and
- 15 credit hours in program electives, satisfied by courses applicable to the technical education; Leadership, Management, and Military Studies; or general education requirements.[4]

"Common" Knowledge

To better understand the results of the survey, one must first become familiar with the General Education Mobile (GEM) program, the Air University Associate-to-Baccalaureate Cooperative (AU-ABC) program, and the promotion requirement for

CCAF-degreed senior enlisted leaders. The following sections offer insight into the foregoing prior to discussing the survey results.

Filling the Gap

The Air Force provides several opportunities for an Airman to satisfy the CCAF's general education requirements. Through on-base or base-sponsored test centers, Airmen can earn college credit free-of-charge by earning qualifying scores on any of 33 introductory College-Level Examination Program subject examinations.[5] Additionally, the CCAF has formed partnerships with regionally accredited civilian academic institutions that offer freshman/sophomore general education courses through GEM. This distance-learning platform allows general education courses to be offered anytime, anywhere through the Air Force Virtual Education Center. Thus, it facilitates accelerated completion of the CCAF and reduces the effect of deployments, permanent changes of station, and other family commitments on the education of Air Force enlisted personnel.

A Stepping Stone

The Air Force maximizes the application of military career education and training through partnerships established within the AU-ABC program. This cooperative connects CCAF AAS graduates with online four-year degree programs related to their AAS degree and has exceptional value for the Air Force. The AU-ABC program includes postsecondary regional and nationally accredited schools that offer bachelor's degrees that can be completed in as few as 60 semester hours beyond the CCAF AAS. Every participant receives a binding degree-completion contract that locks in transfer credit and documents remaining degree requirements. The requirements for an AU-ABC degree may also be completed after Airmen retire or separate from the Air Force.

Because I Have To

The Air Force uses the CCAF AAS as one of many methods to validate an Airman's professional and technical competency. It serves as a key component of the Air Force Enlisted Promotion System and provides a means to ensure the development of NCOs as managers of Air Force assets. An AAS denotes that an Airman has attained the required academic knowledge, coupled with the technical experience, to perform his or her job successfully. Airmen eligible for promotion to the top two ranks of the enlisted force structure—senior master sergeant and chief master sergeant—must have a conferred two-year CCAF degree on or before their promotion eligibility cut-off date. CCAF degrees may be in any discipline.[6] Diplomas are awarded twice a year (April and October), and must be on the current enlisted data verification record in order to reflect in the next promotion cycle.

Methods

The survey instrument was designed around two central yes/no questions: Do you value the degree? Would you recommend it to others? Explanatory questions seemed subordinate to the two high-level questions and allowed for further analysis of the latter. These questions included whether or not the respondent was aware of certain Air Force programs (e.g., AU-ABC and GEM), anticipated degree-completion times, general concepts and their value (e.g., promotion of life-long learning, disciplined approach to problem solving, etc.), obstacles faced during the degree-completion process, and specific competencies that a CCAF course of study has improved (e.g., oral communication, etc.). Several questions had free-text attachments that allowed respondents to further explain their answers. Description of the quantitative data uses infographics and cross-tabulations when the data suggest that a relationship exists. Qualitative data are presented in coded form using a standard key word and concept-based coding chart.

Data were collected over 126 days (between 1 October 2014 and 3 February 2015), provided to the researchers by the CCAF. Of the total student population (n = 6,357) eligible to complete this survey, 1,516 did so. This sample size is sufficient from which to draw conclusions at a confidence level of 99 percent.[7] During the initial data-review phase, certain survey limitations emerged—for example, the use of biased prompts. The directions for certain yes/no questions instructed the respondent, "If No, please explain" when he or she selected a no answer. Therefore, free-text responses were not encouraged if the respondent selected yes. Some respondents chose to ignore the instructions and write positive remarks that were coded for later analysis. Based on the survey instructions, many write-in responses are biased towards the negative and do not represent an overwhelming negative opinion—only the presentation of the directions to the respondent. Suggestions to improve the survey instrument itself can be found in the recommendations section.

Results

Quantitative

The primary two questions addressed the value of the degree and whether or not the respondents who completed the course of study would recommend it to others. The vast majority of students (92 percent and 97 percent, respectively) answered yes. A cross-tabulation with other questions was conducted to determine relationships between those who do or don't value their degree and other related factors. Of those who value their degree (n = 1,385),

- 99 percent (n = 1,376) would recommend the degree to others;
- 17 percent (n = 240) did have a previous CCAF degree;
- 72 percent (n = 995) said this was their first degree earned since completing high school;

- 5 percent (n = 75) were unsure or had no plans for additional education;
- 64 percent (n = 890) clearly understood GEM and its relationship to the CCAF; and
- 64 percent (n = 880) understood the AU-ABC program.

Of those who do not value their degree (n = 128),

- 70 percent (n = 89) would recommend the degree to others;
- 8 percent (n = 10) did have a previous CCAF degree;
- 52 percent (n = 66) said this was their first degree earned since completing high school;
- 15 percent (n = 19) were unsure or had no plans for additional education;
- 43 percent (n = 54) clearly understood GEM and its relationship to the CCAF; and
- 42 percent (n = 54) understood the AU-ABC program.

Tables 1 and 2 examine relationships between graduates' responses for the purpose of better comprehending how and/or why Airmen value their degrees. For example, individuals who value their degree and desire more education believe that it could improve their mission. These Airmen are more likely to grasp the importance of education and the various intangible benefits that come with it. Similarly, these same Airmen demonstrate awareness of the importance of the CCAF degree to enlisted development. The aforementioned relationships do not exist among Airmen who do not value their CCAF degree.

Table 1. Correlations among Airmen who *value* their CCAF degree

	Desired Education Level	*GEM Understanding*	*AU-ABC Understanding*	*Increased Professionalism*	*Promotion of Life-Long Learning*	*Positive Mission Impact*	*Importance to Enlisted Development*
GEM Understanding							
AU-ABC Understanding		**					
Increased Professionalism	*	**	**				
Promotion of Life-Long Learning	*	**	**	**			
Positive Mission Impact	**	**	**	**	**		
Importance to Enlisted Development	**	**	**	**	**	**	
Disciplined Problem Solving	*	**	**	**	**	**	**

** = significant correlation in an error-free state

* = significant correlation not accounting for the potential type-one error. (Such an error occurs when multiple relationships are tested at once. Each is tested at a 95 percent confidence level. Therefore, when researchers test eight different situations, their error rate multiplies from 5 percent to 5 percent x 8 tests. To account for the potential error, one reduces the 5 percent error window by the number of relationships tested.)

Table 2. Correlations among Airmen who *do not value* their CCAF degree

	Desired Education Level	*GEM Understanding*	*AU-ABC Understanding*	*Increased Professionalism*	*Promotion of Life-Long Learning*	*Positive Mission Impact*	*Importance to Enlisted Development*
GEM Understanding							
AU-ABC Understanding		*					
Increased Professionalism							
Promotion of Life-Long Learning	*			**			
Positive Mission Impact			*	**	**		
Importance to Enlisted Development				**	**	**	
Disciplined Problem Solving		*		**	**	**	**

** = significant correlation in an error-free state

* = significant correlation not accounting for the potential type-one error

It was interesting to note in the cross-tabulation results that, whether or not students valued their degree, the majority were interested in pursuing additional education. Further, of those who did not value their degree, the vast majority (70 percent, n = 89) would still recommend the CCAF degree to others. It was also clear that students who did not value their degree were less likely to understand the GEM and AU-ABC programs. Comparison of the correlation coefficients of those who valued their degree and those who did not indicated a significantly higher degree and number of items that correlated. That is, graduates who understood the program were more able to discern its value and felt that it affected more aspects of their development for the better.

The data also showed that education is important to students: 36 percent (n = 548) wished to pursue a bachelor's degree, and 49 percent (n = 741), a master's degree. The correlations in tables 1 and 2 also demonstrate that students with a higher level of desired education (those who likely better understood the impact of education) also valued the CCAF degree and were more inclined to perceive benefits in other areas. Most students (67 percent, n = 1,015) plan to pursue additional education within one to three years, some of them (24 percent, n = 356) expecting to take four years or longer. The researchers must acknowledge that all respondents to this survey completed their CCAF degree, but when asked about barriers they experienced, 45 percent (n = 1,162) indicated that daily workload and family life made earning their degree more difficult.

Academic and life skills were also sampled via multiple selection (e.g., selection of all that apply) questions to determine if a CCAF degree enhances certain skills. Table 3 presents the skill with the response frequency and the percentage of people who did and did not report an improvement in this skill.

Table 3. Impact analysis of CCAF degree skills

Skill	*Count*	*Improved*	*Not Improved*
Technical competence in my career field	779	51%	49%
Oral communication skills (both interpersonal and briefing)	1,008	66%	34%
Writing skills	792	52%	48%
Decision-making skills	673	**44%**	56%
Critical-thinking skills	717	**47%**	**53%**
Leadership effectiveness	816	54%	46%
Followership skills	566	**37%**	**63%**
Professionalism	771	51%	49%
Resilience	534	**35%**	65%
Confidence to take the initiative	713	**47%**	**53%**
Ability to develop innovative improvements on the job	511	**34%**	**66%**

The data suggest that many skills were improved but that others were not. Over 50 percent of the respondents did not select decision making, critical thinking, followership, resilience, confidence to take the initiative, and ability to develop innovative improvements on the job as skills that their CCAF degree improved. These findings contrast responses to an earlier survey question whereby 80 percent (n = 1,211) of the students felt that earning a CCAF degree increased an Airman's professionalism, and 84 percent (n = 1,273) believed that the CCAF plays an important role in developing a professional enlisted corps. It is possible that the wording of the questions played a role in this difference; however, the reliability of the instrument or internal consistency may need to be reviewed in future versions. Furthermore, some students may have had preexisting skills and therefore did not see the CCAF as a source of improvement. For example, 30 percent of the graduates possessed a degree prior to completing their CCAF degree. If they learned writing skills during that time frame, then they would be less likely to attribute that improvement to their CCAF degree.

Qualitative

Qualitative data were collected using free-text responses to provide amplifying information for specific questions. Based on the design of the survey instrument, students were encouraged to enter a free-text response to *Q1: Do you value your CCAF degree?* and *Q2: Do you recommend completion of a CCAF degree to others?* only if they selected no. Because students who chose yes were not offered the option of a free-text response, Q1 and Q2 free-text responses were biased towards the negative.[8]

The most significant negative responses of those who chose no (n = 128) when asked Q1 or Q2 were as follows:

- I finished the degree only because I was going to receive a negative enlisted performance report (EPR).

- It's an EPR bullet and provides no outside Department of Defense value. Bachelor's degrees should hold more weight.
- It's a generic degree that only the Air Force values.
- I have been told by more than one agency that they will not accept it.
- It's merely a stepping stone and means nothing in the civilian world.

In addition, many people obtained CCAF degrees who already had a bachelor's degree (n = 25), and some said that their CCAF degree or CCAF credit was not transferable to other universities or that it carries no weight in the civilian world (n = 22). The most common negative response of those who chose no (n = 47) when asked *Q2: Do you recommend completion of a CCAF degree to others?* was that the degree is used only for promotion purposes (n = 13) (table 4). The other coded responses, though informative, make up a fraction of the total responses to Q2 and will not be presented here. The researchers must acknowledge that the preceding negative comments were enlightening but make up a relatively small subsection of the responses. The vast majority of respondents indicated yes to both questions: that their degree had value and that they would recommend it to others.

Table 4. Qualitative rankings for CCAF value comments

Value of the CCAF Degree	*Total*	*Recommend to Others*	*Total*
No value outside the Air Force	26	Yes, promotion requirement	13
Already have a bachelor's degree	25	Yes, if the Air Force is your career choice	8
Not transferrable outside the Air Force	22	Credits or skills don't transfer	7
Mandatory	16	The CCAF is not a real institution	4
Necessary only for promotion	13	Waste of time	4
Not a reputable degree	12	Promotion\career progression	3
Promotion\career progression	11	Good only for the EPR bullet	3
Grand Total	128	Grand Total	47

The additional comments or feedback to the questions contained a significant number of complaints about individual circumstances or opinions not related to the quality of the CCAF degree. Four general themes emerged from the analysis (table 5). Most graduates' comments reflected a general satisfaction with their CCAF degree and the effect it will have or has had on their career. The next-most-frequent set of comments reflected negatively about the time it takes the CCAF to process credits and/or transcripts of student records.

Table 5. Qualitative rankings: additional comments section

Additional Comments or Questions	*Total*
Satisfaction with the degree's impact on career	46
Long transcripts/transfer-credit processing timelines	41
Lack of information or program support	26
Lack of significance/transferability to civilian sector	18

Several graduates commented on the lack of support from their chains of command in obtaining information regarding their degree. Others noted the lack of information on the AU-ABC or GEM programs; however, it is important to note that the research team found this information fairly quickly on the CCAF website. Some students, even those who disagreed with Q1 and Q2, still see the value in the CCAF degree:

> I put [that] I disagree with two of the questions, and I think I owe an explanation. I personally was never pushed to get my CCAF. In fact as I took classes, my general Ed classes were the last thing on my mind. There are a lot of Airmen out there that do not realize that you can take about five classes and get your Associate's. This is what needs to be told to the Airman. Yes it will help you in your career, but it only takes about a year to complete. Now that I am making my way up the chain, I have an understanding, and [I] am giving that information to my Airmen.[9]

Qualitative Website Analysis

The researchers conducted a qualitative review of the CCAF's web footprint to further explain some of the qualitative comments since many consistent themes emerged. One was that students felt they must obtain a CCAF degree "or else" and that the value of the degree, both tangible and intangible, was not always clearly understood. A comparison of a small sample of community college websites indicated how the CCAF website ranks with those of other community colleges (see table 6 and the figure below).

Table 6. A qualitative comparison of community college website content

Homepage Elements	*Community College*					
	CCAF	*DTCC*	*TCC*	*OCCC*	*HACC*	*MGCCC*
President's Welcome Message	X					
Frequently Asked Questions	X					
About Page	X	X	X	X	X	X
Accreditation	X					
Continuing Education	X	X	X	X	X	X
College Catalog	X	X	X	X	X	X
Credit Transfers	X	X	X			
Admission/Application Info		X	X	X	X	X

Table 6. A qualitative comparison of community college website content (*continued*)

Homepage Elements	*Community College*				
	CCAF	*DTCC*	*TCC*	*OCCC*	*HACC*	*MGCCC*
Student Resources		X	X	X	X	X
Events Calendar		X	X	X	X	X
College News Feed/Blog		X	X	X	X	X
College Magazine		X		X	X	
Social Media Links		X	X	X	X	X
Student Highlights		X	X		X	X
Request More Information		X	X	X	X	X

DTCC = Delaware Technical Community College*
TCC = Tidewater Community College*
OCCC = Oklahoma City Community College*
HACC = Harrisburg Area Community College
MGCCC = Mississippi Gulf Coast Community College

* = website depicted in the figure below

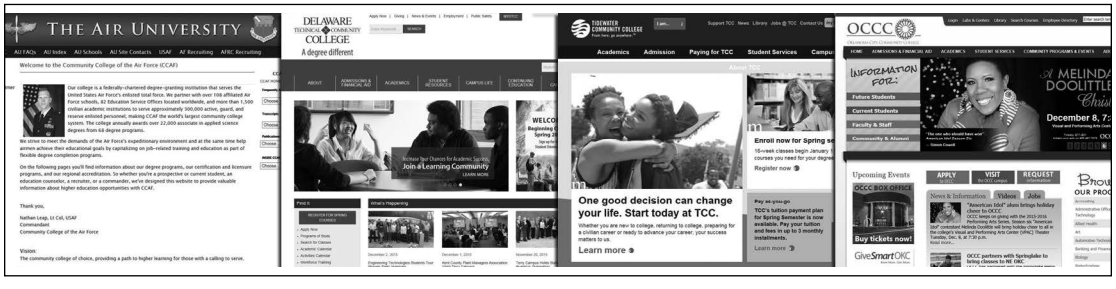

Figure. Common community college pages compared to the CCAF page

The results of the qualitative website analysis revealed a general framework used by most community colleges when they developed their websites. The standard framework consisted of rich information on academics and program admission, social media links, university events, and press coverage of student and college achievements. Table 6 shows a fairly large disconnect between what the CCAF displays on its website as compared to those of some academic peers. Roughly 90 percent of the CCAF site consists of the president's welcome message and photo, with the remainder taking the form of a few drop-down menus that link to frequently asked questions, accreditation, the college catalog, and information on credit transfers. The figure above depicts the difference in aesthetics and layout between the aforementioned sites.

Discussion and Recommendations

The sum of the data collected shows that graduates think the CCAF provides a worthwhile education to Airmen, encourages learning, facilitates promotion, and is

beneficial to the mission of the Air Force. One challenge that did emerge entails assessing the effectiveness of the degree and differentiating between individuals who obtained an education from the CCAF and those who learned very little but felt they must attend to be promoted. Based on the preceding and the data collected, the following recommendations emerged.

Improve the Resolution of the Exit Survey

The survey instrument itself could benefit from a thorough review and analysis. Several technical errors noted by the researchers could affect its reliability and validity. First, questions that use yes/no with free text should include unbiased directions to capture both positive and negative feedback, thus assisting in determining specifically why respondents made the choice they did and eliminating bias to the negative in the write-in responses.

Second, the specific goals of the CCAF should be identified, and survey questions about those goals should be the focal point. Asking questions such as *Q13: Does the CCAF play an important role in developing a professional enlisted corps?* forces a guess or unsupported opinion from respondents who have no specific knowledge of the entire corps or the linkage between the CCAF and professionalism outside their own personal experience.[10] Open-ended comments support the idea that this question might have been confusing or misunderstood by respondents.[11]

Third, developers of the CCAF graduation survey did not include "neutral" or "I don't know" as a response. Although the literature supports this survey method in most instances to avoid evasion bias, in some cases respondents generally feel neutral regarding a subject or don't know an answer.[12] The example in the previous paragraph demonstrates a scenario in which a respondent might answer, "I don't know" but in this study was forced to provide an answer nevertheless. In the open-ended feedback section, a graduate highlighted this problem: "I would have likely selected Neutral as a response for most questions had it been an option in this survey."

Finally, it is best to assess only the constructs that were specifically taught and that can be identified and assessed as outcomes of a CCAF program. For example, unless the CCAF specifically teaches resilience or followership skills (directly, not incidentally), it is best not to ask people if such indirect skills have improved since this variable is difficult to measure. A respondent generally cannot make such introspective measurements accurately and will have a tendency to overstate his or her knowledge or performance when indirect connections are present.[13]

Improve the Quality of the CCAF Website

Qualitative analysis of the CCAF website revealed a number of areas for improvement. In today's digital world, Internet marketing is more important than it has ever been. Although the CCAF is not a traditional community college that requires tuition to operate, delivering information and providing value to the customer are still of great importance. Research has demonstrated the correspondence between website design and achieving an organization's strategic goals.[14] A more modern design, matching more closely that of its peers, would allow the CCAF to connect better

with its—mostly millennial—Airmen who grew up in a digital era and look to websites for information and value.

Academics. The CCAF would benefit from adding an academics section to its website, one that would outline briefly each AAS degree and connect it to a civilian-equivalent function. The public-facing Air Force website, for example, effectively outlines the different AFSCs and their technical training programs.[15] The foregoing would create Air Force–specific and post–Air Force value for Airmen.

Student resources. A student resources section should be added that contains information about the CCAF degree's purpose and that contains sublinks to the existing GEM and AU-ABC sections. Additionally, it would contain a link to the various base education offices, much like public community colleges reference their various student centers. This information is available on the Air Force Virtual Education Center, but a bare-bones public-facing site is not a sufficient way to create value for potential or new Airmen who will look there first.

Student and CCAF news feed. The CCAF public-facing website would be greatly improved by adding a dynamic news blog to the main page. The blog would highlight key student accomplishments—specifically, those logically connected to the pursuit or completion of the CCAF degree. Additionally, many articles and stories are posted to the non-CCAF-owned LinkedIn page but are never connected to the college's website. The CCAF could add value by placing organizational news highlights in addition to student and alumni highlights in the main blog.

Social media links. The emergence of social media such as Facebook, Twitter, and LinkedIn allows organizations to track their word-of-mouth impact, which translates from online social media to offline communication.[16] It is difficult to find an organization without a social media presence and equally difficult to find a website without a connection to such a presence. The fact that every college website analyzes links to a social media presence and that the CCAF website does not should substantiate the need for this recommendation. Connecting to social media goes beyond the basics of adding value to Airmen to offering an additional marketing tool for the Air Force.

Although all of the community colleges reviewed were regionally accredited, they did not mention that fact on their public-facing home page, perhaps because it is generally understood that they are accredited, much like their higher-level state colleges. The CCAF, as do many for-profit schools, struggles with validating itself as an equal competitor and—similar to its for-profit cousins—probably benefits more from demonstrating its accreditation than would a traditional community college.

Actively Manage the Image of the CCAF

Although the vast majority of the quantitative results were positive, some themes in the qualitative responses were consistent. Certain students feel that a CCAF education is a check-in-the-box or a necessary hurdle to attain promotion. This in fact may be true, but it would seem that the other benefits should be equally important (e.g., learning new material, obtaining a degree, participating in networking, etc.). Many Airmen receive information about the CCAF from their peers or superiors, and the attitudes of those people will influence young Airmen.[17] The CCAF should

promote itself by providing student success stories, testimonials, value statements, and other informative remarks about education so that Airmen see the entire value of a CCAF education—not just the opinions of others.[18] Migrating away from a word-of-mouth presence to a web-based one may allow the conveyance of more accurate and holistic information to future students. Moreover, selling the CCAF as though it were competing with other community colleges may help leadership move away from the monopoly mind-set and assist with highlighting the true and full value of a CCAF degree.[19]

Conclusions and Future Research

Overall, CCAF graduates value their degree, but an important question for future research remains: *Why?* Given the inadvertently integrated survey bias, there were no open-ended questions directly geared to obtain feedback from graduates about why they selected yes to valuing their degrees—only those who selected no received that option. Many of the *additional comments* that alluded to degree value concentrated on promotion opportunity, indicating that Airmen might value the degree only for the reasons that many Airmen do not value the degree—that it is useful only for promotion. There appears to be a cultural framing of the degree in the Air Force that obtaining it for promotion is important; however, not much mentoring of young Airmen addresses the necessity of having the theoretical support for their field or any of the general benefits of higher education. Further, Airmen seem to perceive the *automatic* awarding of many of their credits and the "everybody gets one" aspect of the CCAF degree as detracting from its value. Many of them fail to see that they are an exclusive group of degree holders and that they spend multiple 80-hour weeks in an accredited classroom environment (most with 80 percent minimum passing scores) to obtain their *automatic* credits. Immediate supervisors need to make their Airmen aware of the value of education instead of emphasizing the promotion aspects of the degree.

Knowing Airmen's perspectives regarding the value of their degree is only the first step. Because the degree is funded, accepted, and used by the Air Force as a promotion discriminator, it has internal value—whether or not the Airman realizes it. Future research should consider how civilian employers value the CCAF AAS degree if an Airman were to retire or separate and present it on a resume for a job in his or her related field. Only by combining the results of both studies will the true value of the degree become apparent.

Finally, this study should be replicated two years after implementation of its recommendations. The results would paint a more accurate picture of graduates' assessment of the value of their degree since the improved CCAF survey will generate more reliable data. Those data, improved supervisor mentoring regarding the impact of higher education, and a more modern CCAF website that engages students will undoubtedly generate more value for current CCAF students and the college's alumni. ✪

Notes

1. Robert Goetz, "CCAF Continues to Provide Value to Air Force, Enlisted Members," Joint Base San Antonio–Randolph Public Affairs, 11 September 2014, http://www.jbsa.mil/News/News/tabid/11890/Article/598856/ccaf-continues-to-provide-value-to-air-force-enlisted-members.aspx.
2. Edwin Hernandez, "Value of the CCAF Degree Article," Community College of the Air Force Alumni Group, January 2015, https://www.linkedin.com/grp/post/64715-5952882538375626754.
3. *Air University: Community College of the Air Force, 2014–2016 General Catalog, Number 20*, 9 March 2015, http://www.au.af.mil/au/barnes/ccaf/catalog/2014cat/2014_2016_General_catalog.pdf.
4. Ibid.
5. "General Education Mobile Program," CCAF, accessed 23 April 2015, http://www.au.af.mil/au/barnes/ccaf/publications/gem_web_brochure.pdf.
6. Air Force Instruction 36-2502, *Enlisted Airman Promotion/Demotion Programs*, 12 December 2014, 10, http://static.e-publishing.af.mil/production/1/af_a1/publication/afi36-2502/afi36-2502.pdf.
7. "Sample Size Calculator," Survey System, accessed 27 April 2015, http://www.surveysystem.com/sscalc.htm.
8. We would like to thank Dr. Marques Armant for his help with the initial scrub and coding of the qualitative data for questions one and two, as well as the open-ended general comments.
9. Direct quotation from a CCAF graduate's *additional comments/questions* submission.
10. Sara Dolnicar, "Asking Good Survey Questions," *Journal of Travel Research* 52, no. 5 (March 2013): 551, doi:10.1177/0047287513479842.
11. Respondent comment on *Question 13: CCAF plays an important role in developing a professional enlisted corps*: "Based off of my own experience that answer is [an] agree and disagree answer. I've worked with people who are book-smart and can complete their CCAF quickly; however, when it comes to utilizing that learned professionalism from attending college, it doesn't translate because of the lack of experience of being in the field. I've learned professionalism over the years through experience in working in my current AFSC. I believe college had a bit to do with it but not entirely." Response to *Question 14: CCAF graduates tend to have a more disciplined approach to problem solving*: "Based off of my own work experience, this is another 'agree and disagree' answer. The college courses expose someone to more situations when a disciplined approach is necessary, but the on-the-job training and experience will teach and cultivate the disciplined approach to problem solving needed to meet daily mission requirements. I've worked with individuals who have completed their CCAF degree and when trying to apply the disciplined approach they should have, that approach doesn't happen due to the different environmental pressures they are exposed to that are not applicable in the college setting."
12. Dolnicar, "Asking Good Survey Questions."
13. Norman Bradburn, Seymour Sudman, and Brian Wansink, *Asking Questions: The Definitive Guide to Questionnaire Design—for Market Research, Political Polls, and Social and Health Questionnaires*, rev. 1st ed. (San Francisco: Jossey-Bass, 2004).
14. Wei-Shang Fan and Ming-Chun Tsai, "Factors Driving Website Success: The Key Role of Internet Customisation and the Influence of Website Design Quality and Internet Marketing Strategy," *Total Quality Management and Business Excellence* 21, no. 11 (November 2010): 1141, doi:10.1080/14783363.2010.529335.
15. "Technical Training," US Air Force, accessed 3 December 2015, http://www.airforce.com/joining-the-air-force/technical-training/.
16. Gian M. Fulgoni and Andrew Lipsman, "Digital Word of Mouth and Its Offline Amplification: A Holistic Approach to Leveraging and Amplifying All Forms of WOM," *Journal of Advertising Research* 55, no. 1 (18 March 2015): 18–21, doi:10.2501/JAR-55-1-018-021.
17. Respondent comment: "More emphasis on credibility of CCAF needs to happen at levels beyond local chain of command. We brief it, but the troops aren't buying it. Rather, [they are] complying for the sake of complying. Consider changing the name to Air Force University."
18. Keith Absher and Gerald Crawford, "Marketing the Community College Starts with Understanding Students' Perspectives," *Community College Review* 23, no. 4 (Spring 1996): 59.
19. Craig A. Clagett, "Using Data to Optimize Community College Marketing," *New Directions for Institutional Research* 2012, no. 153 (Spring 2012): 49–62, doi:10.1002/ir.20006.

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A Shot in the Dark

Shedding Light on Exoatmospheric Situational Awareness with Alternate Sensor Utilization

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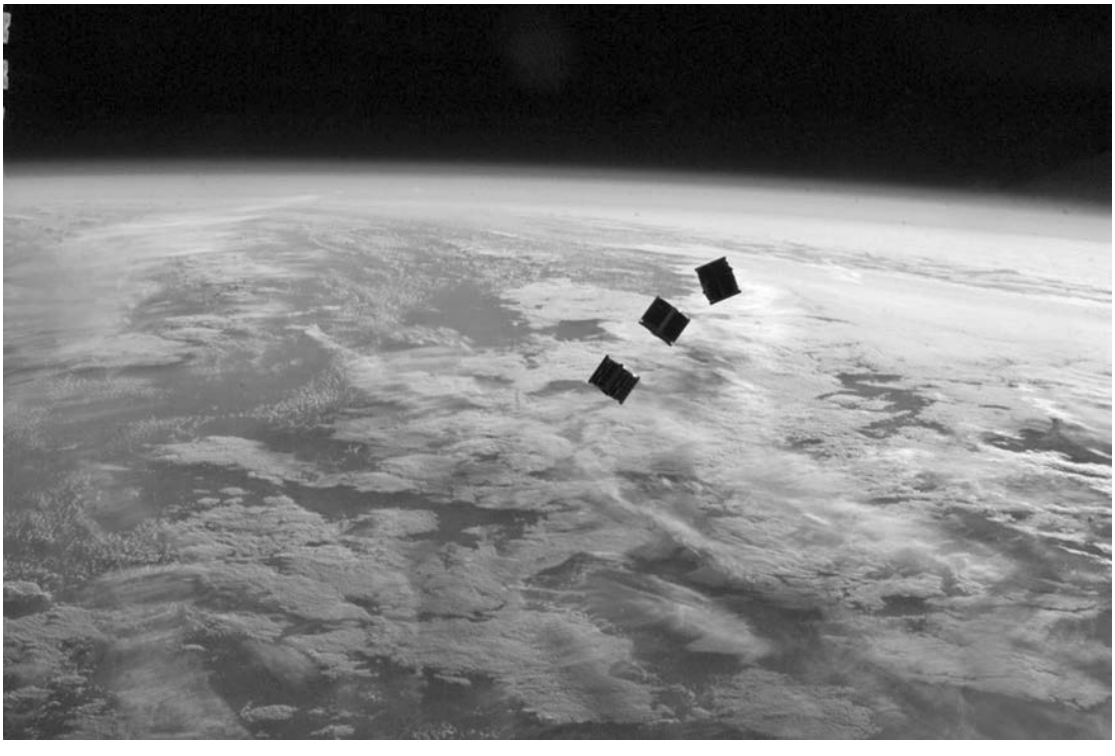

It's not rocket science—it's harder. Missile defense is not simply a matter of intercepting a bullet with another bullet. The relative speed of the small reentry vehicle (RV) is faster than that of a bullet by an order of magnitude. Furthermore, you're often firing in the dark into a lot of clutter. However, hitting an RV is not only possible but also has become the expected outcome of rigorous testing. One area for improvement is acquiring rapid and accurate situational awareness in

time to find and destroy the RV. That's where CubeSats, or small satellites, equipped with advanced sensors may shed some light on the darkness.

Introduction to Missile Defense

The ballistic missile defense system (BMDS) is an integrated architecture of land, sea, air, and space assets designed to defend the United States, deployed forces, allies, and friends against all ranges of enemy ballistic missiles in all phases of flight (boost/ascent, midcourse, and terminal). The missile defense architecture provides a defensive operations capability around the clock. The strategy of the Missile Defense Agency (MDA) is to establish a capability-based acquisition approach to field initial elements and then build upon this foundation as new technology matures. Although the currently fielded system provides effective defense for the United States against the defined ballistic missile threat, the weapon system continues development and testing to meet evolving threats. Moreover, just as the need for improved space situational awareness has long been well justified, so does a need exist to continuously improve RV discrimination capabilities for missile defense.[1] Some solutions may help in both mission areas to better defend our critical space assets and our nation.

Areas for Improvement

Even with the myriad sensors available to the Department of Defense (DOD), an area for system improvement remains fully effective battlespace situational awareness. One of many efforts under consideration to better support the missile defense war fighter is further research on target-signature exploitation and multistatic CubeSat technology. The goal involves investigating the viability of utilizing a CubeSat platform equipped with specialized payloads to determine technical feasibility of low-cost sensing for target-signature exploitation. The applicability and practicability of hyperspectral and multistatic systems, as well as data collection through CubeSat constellations, all have potential. As demonstrated through real-world events, timely missile detection, together with the typing and resolving of objects, is crucial for establishing useful tracks for the possible cueing of ground-based sensors. The challenge resides in target-signature exploitation, which is currently limited by technological capabilities and sensor availability for collection opportunities, and in the associated high cost for supporting overhead sensors.

CubeSats could support other needs of war fighters, such as time-sensitive sensor fusion, by increasing the capabilities of much-needed space situational awareness. CubeSats are just one of many solutions, whether pre-positioned in orbit or ride sharing on missile defense interceptors. Hosted payloads, redesigned command and control, and communications platforms have merit as well. Potentially, with cooperation among the DOD's combatant commands and services, MDA, and national agencies, joint system development and coordination could field solutions to support improved space situational awareness, space protection, and missile defense capabilities.

As space-based sensing for military applications continues to grow as an integral part of advanced warfare, methods of overhead target-signature exploitation will advance and mature. Given the emergence of CubeSats, the utilization of low-cost sensing technologies with increased overhead coverage is becoming more evident and practical for military applications to support war-fighting operations and defense of the homeland. CubeSats might never fully replace larger space systems, but they could provide some utility to augment those systems with vital information, as have other unattended sensors in past ground conflicts.[2]

Consider the following improvements in the works. The BMD Overhead Persistent Infrared (OPIR) Architecture (BOA) processes data from multiple overhead sensors to detect, track, and resolve ballistic missile threats. The BOA's operational objective is to become an integral sensor-fusion-based contributor to the overall BMDS. The challenge in detecting missiles, resolving objects, conducting missile typing, and other phenomenology remains in target-signature exploitation.

CubeSat payload technology is improving rapidly and has the potential to support such exploitation. For low-cost solutions, the payload element faces numerous issues, including size, weight, and power (SWaP or SWaP-C with cost). Additional limitations to overcome include management of the required coverage, mechanisms controlling satellite separation, scalability for multistatics and hyperspectral sensing, and the necessary constellation size. Initially, CubeSat's target-object observations and data would likely be relayed immediately to a ground station for processing and subsequent tasking of other assets. Initial target detection (e.g., using OPIR) can inform a CubeSat constellation to prepare for object tracking and signature exploitation. Doing so calls for effective decision processing and communication, which are available with existing technology. CubeSats may yield a low-cost mechanism to position specific sensor technologies where and when they are needed, and they may increase the probability of obtaining data vital to supporting various military applications across the DOD.

Both government and industry are making a significant effort to explore improvements in CubeSat technology, including evaluation of various payloads, platforms, and constellation sizes. Theoretical research is under way to identify, evaluate, and establish physics-based models. Experiments are testing theoretical models through appropriate simulation methods to establish confidence in research viability and to better define and measure the validity of payload selection. Finally, prototypes are demonstrating proofs of concepts, and some operational systems are already employed.

Because such research will benefit many users, we need a collaborative effort utilizing a diverse group of researchers and operators from throughout the community to demonstrate any differentiated value in this emerging growth area. Target-signature detection and exploitation through the use of CubeSat or other hosted payload technology will offer a direct benefit to various sponsors, including the MDA, military, and other national agencies. A twofold benefit emerges through demonstration of low-cost space-based sensing to observe specific phenomena regarding target-object signatures as well as the additional capability to allow BOA to supply high-quality precision cues to ground-based sensors. Improvements can also assist the MDA's ongoing efforts to provide better postintercept assessment. The use of CubeSat con-

stellations positioned for the right coverage at the right time through novel methods and miniaturization of specific payload-sensing technology can produce these effects.

CubeSats might integrate and rely on the cueing of larger space platforms on the one hand and might even augment the more capable systems on the other. The Pentagon plans to allocate billions of dollars to new initiatives over the next five years, including putting into orbit surveillance sensors that will expand commanders' awareness of space activity. Space situational awareness has been growing in importance and can greatly enhance the MDA's highest-priority mission to defend the homeland and forces assigned around the world from ballistic missile attack.

The Need for Change

As technology rapidly evolves, traditional large-scale legacy military system design and associated system engineering approaches must evolve as well. Developing effective, resilient, and affordable systems that meet the system's stated mission in a timely manner can be demanding.[3] This environment often drives incremental change and the use of common form, fit, and function commercial-off-the-shelf (COTS) components architected into military applications. The latest Department of Defense Instruction 5000.02, *Operation of the Defense Acquisition System*, 7 January 2015, which supports incremental advances in missile defense and space systems, reflects the design concept. Where feasible, taking advantage of common small-form-factor plug-and-play COTS products allows for a reduction in design cost and provides an avenue to insert technology advancements into military applications at an increased pace.

Our nation's space community embodies the same concept. According to the National Geospatial-Intelligence Agency, its success will depend on how it embraces change, especially that which is enabled by advances in technology in support of global coverage—one of the agency's stated mission areas.[4] On 24 April 2013, Gen William L. Shelton, commander of Air Force Space Command at that time, gave the following statement to the Senate Armed Services Committee:

> Our satellites provide a strategic advantage for the U.S., and as such, we must consider the vulnerabilities and resilience of our constellations. [We] are examining disaggregated concepts and evaluating options associated with separating tactical and strategic capability in the missile warning and protected communications mission areas. We are also evaluating constructs to utilize hosted payload and commercial services, as well as methods to on-ramp essential technology improvements to our existing architectures. Beyond the necessity of finding efficiencies and cost savings, we may very well find that disaggregated or dispersed constellations of satellites will yield greater survivability, robustness and resilience in light of environmental and adversarial threats.[5]

The preceding arguments support incremental development cycles, use of COTS technology, rapid technology insertion, and dispersed space-based constellations. A need exists to further examine target-signature exploitation through hyperspectral sensing and multistatics and to concentrate on miniaturization of these sensing technologies. The resulting systems might be hosted on small, space-based platforms to give the BMDS increased and persistent coverage.

Current Technological Direction

Sensing and Space-Based Platforms

Target-signature measurement, intelligence, and exploitation are critical for military applications and maintenance of a competitive advantage over our adversaries. Obtaining intelligence data on targets allows the detection, tracking, and identification of distinctive characteristics of fixed or dynamic target sources. These data include material, acoustic, and nuclear as well as chemical and biological intelligence. Traditionally with the BMDS, obtaining data has occurred primarily through the use of radar technologies combined with specific, large, space-based sensor assets that have many competing priorities. The purpose within the BMDS for collecting these data is for surveillance, target detection, target tracking, typing, discrimination, and postintercept assessments. The BMDS application may have its specific needs, but these collections inform many military applications.

To assist with space-based data collection and priority management, the MDA and its Space Knowledge Center made strides with the space community to define a planning infrastructure for preplanned and cue-related BMDS tasking. This approach offers a structure for the MDA to request and plan for data-collection events.

CubeSats are becoming a research and technology-development platform that can capitalize on the latest technologies and innovative micro/nanomanufacturing techniques.[6] As space-based sensing for military applications emerges and becomes an integral part of advanced warfare, overhead target-signature exploitation methods will continue to advance and mature. Now, with the emerging technological advance of CubeSats, the use of low-cost sensing technologies with the possibility for increased overhead coverage is becoming more practical for military applications.[7] The future will likely see more small satellites dedicated to a particular mission objective.[8]

Overview of Hyperspectral Sensing

Within the last decade, the demand for remote sensing data to examine and understand the composition of the earth's surface has significantly increased. Applications that rely on these data include agricultural studies, coastal research, marine analysis, geology, climatology, and the defense industry. Hyperspectral imaging addresses the needs of users of remote sensing data by combining spatial imaging systems with spectroscopy. Hyperspectral imagers supply a digital image in which each pixel consists of a spectral signature.[9] Ensuing images, along with the underlying spectral components, can identify Earth surface types (fig. 1).[10]

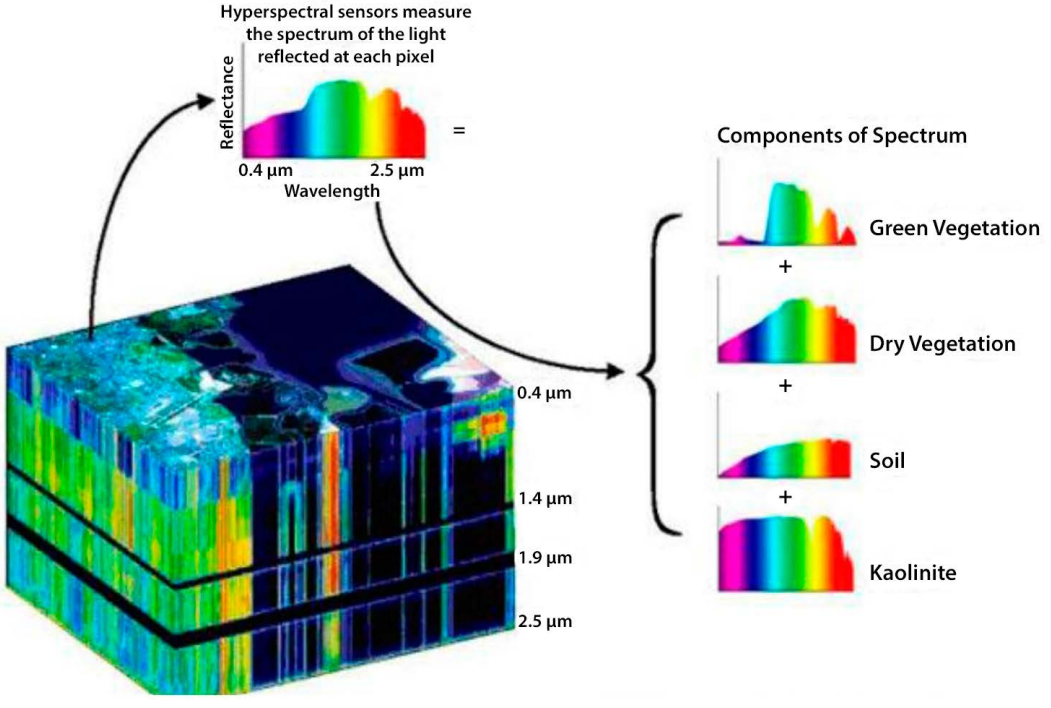

Figure 1. Hyperspectral imaging. Courtesy NEMO Project Office, United States Navy

One defense-related application of hyperspectral imaging is target detection and discrimination (i.e., determining which pixels in a particular image are likely to contain known target materials).[11] Research continues to leverage existing target detection, discrimination concepts, and algorithms and to investigate their incorporation into the BMDS via CubeSats.

Overview of Multistatics

Multistatic operation refers to a network of sensors that includes more than a single transmitter or receiver. Such operations build upon monostatic (colocated transmitter/receiver) and bistatic (spatially separated transmitter/receiver) concepts and can address the limitations of a sensor system's ability to detect and track objects of interest. Figure 2 depicts a multistatic radar scenario.[12] As shown in this illustration, each node in a multistatic sensor network can perform one of three functions—transmitter, receiver, or transmitter/receiver—to carry out the mission while the comprehensive system can be designed to maximize performance against specific or wide-ranging scenarios.[13]

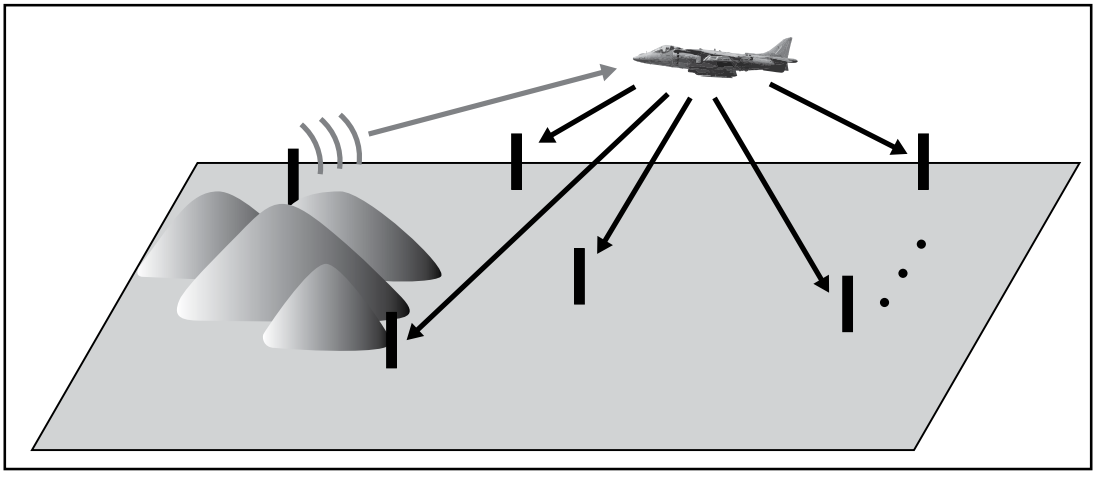

Figure 2. Multistatic radar vignette. (Reprinted from "Communication-Radar Signal Processing Sys.," Microwave and Fiber Optics Laboratory, May 2014, http://mfol.ece.ntua.gr/communication-radar-signal-processing-systems/.)

As threats to the homeland and allies become more difficult to detect, track, and discriminate, conventional radars may not necessarily provide the best means of contending with adversary systems.[14] Most current radars within the BMDS are monostatic; thus, the utilization of supplementary, inexpensive CubeSat receivers could enhance performance across the kill chain.[15]

One key advantage of a monostatic system is the use of interferometry to obtain and process multiple target measurements and supply greater azimuthal discrimination.[16] A notable disadvantage of such a system is its low resilience to specific countermeasures. Figure 3 illustrates how a stealthy target, based on its design, creates a difficult angle of view for a monostatic node (shown at left), while the other receivers' angles of view are more conducive to detecting the target.[17]

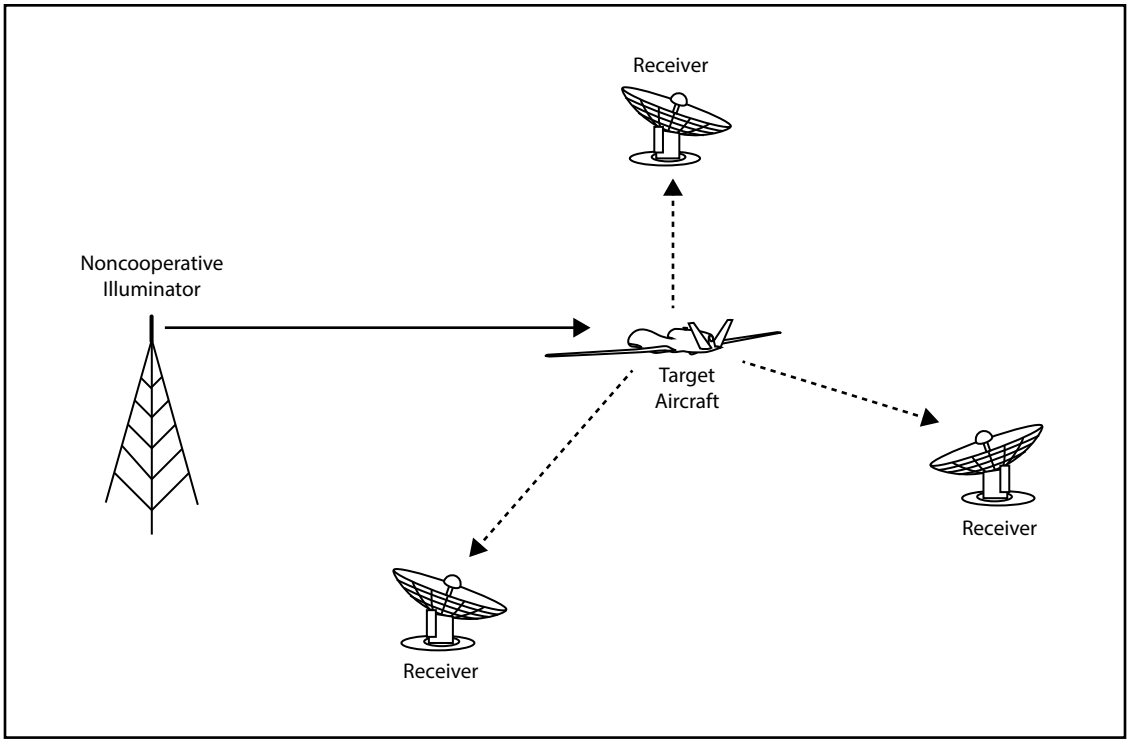

Figure 3. Detection of a target using multistatic radar

Multistatic methods may greatly enhance and supplement the detection, track (through cues), and discrimination functions of existing BMDS assets. The CubeSat community has investigated the use of networked sensors, but to date no organization has produced a multistatic CubeSat network.[18] One approach might use ground-based illuminators to reduce the burden on small satellites with limited apertures, thus providing extended detection or improved discrimination compared to the capability of current systems.

Overview of CubeSat Technology

A single-unit "U" CubeSat is a 10 centimeter (cm) cube with a mass of up to 1 kilogram (kg). The primary mission of a CubeSat host is to offer access to space for small payloads. General features of all CubeSats are as follows:

- Each single CubeSat may not exceed 1 kg mass.
- The center of mass must be within 2 cm of its geometric center.
- Double and triple configurations are possible. In this case, the allowable mass is 2 kg or 3 kg, respectively. Only the dimensions in the Z axis change.

- Another approach is referred to as "swarming" (i.e., using clusters of CubeSats to obtain improved performance from the collective system).

Figure 4 details an isometric drawing of a CubeSat as well as an artist's rendition of a CubeSat in orbit.[19]

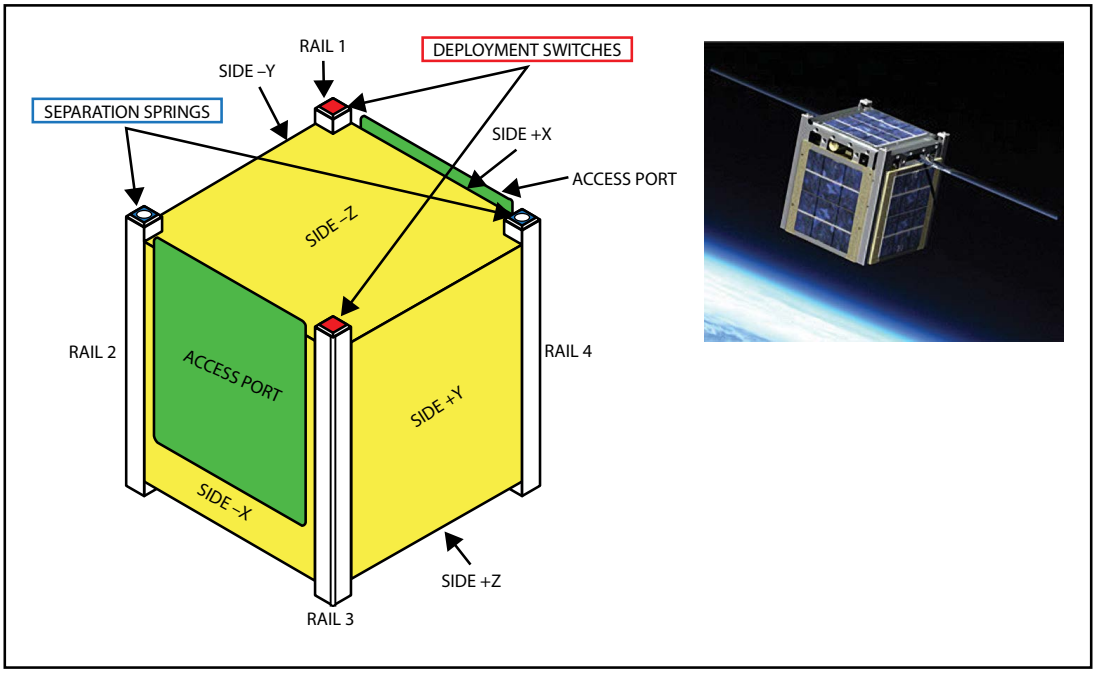

Figure 4. CubeSat image. (Reprinted from Riki Munakata, CubeSat Design Specification Rev 12 [public domain] [San Luis Obispo, CA: California Polytechnic State University, 2009], 10.)

The CubeSat concept was proposed publicly in 2000, and the first satellites launched in 2003. By the end of 2012, more than 100 CubeSats were launched. Today a significant share of the manifests are filled by US DOD-sponsored and industry-built CubeSat missions. Various agencies in the DOD experienced success with early CubeSats (e.g., the Aerospace Corporation's Aerocube series and Boeing's CSTB-1).[20] The division of CubeSats over the years clearly indicates that the use of this type of host for military applications is increasing (fig. 5).[21]

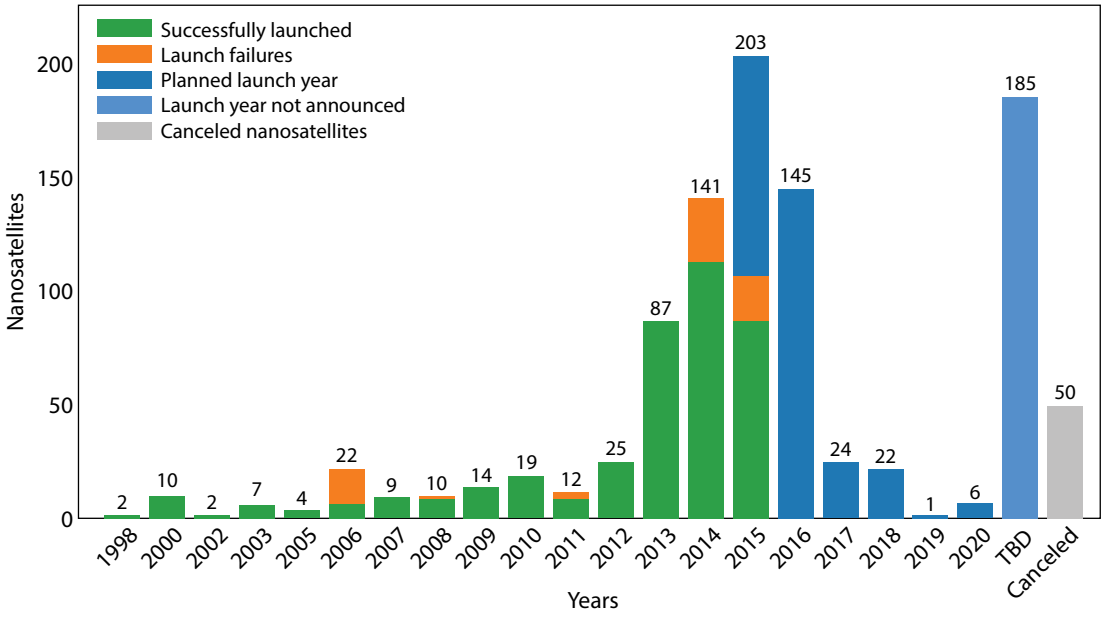

Figure 5. Small satellites by launch year. (Reprinted from "Figures," Nanosatellite Database by Erik, accessed 4 December 2015, http://www.nanosats.eu/.)

Spectral Sensor Miniaturization

Many universities and laboratories are working to advance miniaturization in the form, fit, and function as well as in aspects of the development of spectral sensor algorithm processing. Miniaturization of a hyperspectral sensor calls for consideration of at least three aspects: physical features, software algorithms, and overall viability on a CubeSat-hosted platform. Research on placing this type of sensor in a standard 3U (10 cm x 10 cm x 30 cm) CubeSat envelope has already begun, and many of the primary components are readily available as COTS items. Compression techniques must be utilized to extract the key spectral components of the scene (what the sensor sees) since the data sizes are significant, especially considering the SWaP limitations of CubeSats.

Sensor and Algorithm Development and Modeling

The resulting spectral data cube of an area of interest represents a significant amount of data (one gigabyte or more for a scene), and the digital storage and transmission of these data from orbit constitute a sizable task, even for large-scale modern satellites. Mitigating this large volume of data involves a considerable amount of effort focused on developing computationally based compression techniques for the storage and transmission of hyperspectral data.[22]

Fit, Form, and Function Trade Space

The effectiveness of a proposed multistatic sensor CubeSat network will depend upon a number of factors, including, but not limited to

- the number of CubeSats in the multistatic sensor constellation;
- the availability and capability of the CubeSats;
- CubeSat coverage/distance from intended target at any given time;
- the ability to obtain stereo or multisatellite fused coverage;
- the agility of the sensor and tasking/reporting chains;
- link budget and transmit power of the CubeSats;
- intracommunication technology;
- sensitivity of the ground-station (processing station) receiver; and
- the availability of ground stations for processing multi-aspect CubeSat sensor data.

Development of Multistatic Sensor Algorithms

As with any system that collects and fuses information from multiple sources, the development of multistatic sensor algorithms will prove daunting. Processing will require tailoring to specific mission needs or the ability to update quickly, based on dynamic changes to threat scenes.

To some extent, the MDA's space-based kill assessment experiment is analogous to the ideas presented in this article. The assessment will use a commercially available satellite constellation to host payloads that detect and verify the negation of threat missiles.[23]

Persistent Coverage

CubeSats yield a relatively low-cost mechanism to position specific sensor technologies by using the principles of orbital mechanics. CubeSats can increase the probability of obtaining data to support target-signature exploitation for various military applications. For an example of a commercial venture utilizing the CubeSat platform, one should look to Planet Labs, which recently launched a 28-CubeSat constellation into low Earth orbit for the purpose of providing five-meter-resolution color spatial images of the earth on demand and at high temporal repetition rates. Planet Labs did so with initial private funding of $65 million, far less than the cost of a single "traditional" satellite.[24]

Supply Chain Assessment

Miniaturization by innovative technology companies from all industries has enabled an increase in CubeSat capabilities. This technological progression has made it possible to conduct larger space-research experiments with smaller systems.

There is no indication that this trend towards smaller size will cease in the near future as research and micromanufacturing of components continue to become smaller and more powerful. This new industry has had the effect of overwhelming conventional launch resources.[25] The utility of small satellites is expanding in large part due to the aforementioned advances, greater sophistication of COTS components, and a mind-set change in satellite design driven by adoption of the CubeSat specification.[26] Space access opportunities for small satellites are limited to rideshare opportunities on small-, medium-, and heavy-lift space-launch boosters serving primary payloads.[27]

With limited launch resources, constellation modeling can identify persistent coverage of areas of interest. Additionally, the limited life cycle of each CubeSat platform warrants a complete supply-chain (procurement, manufacturing, and distribution) assessment to determine the viability, overall cost of building additional hardware and replacement, timelines, and feasibility of maintaining that persistent coverage.

Strategic Alignment of Integrated Sensing, Processing, and Exploitation

The emerging threat landscape is decisively global, bringing with it new challenges that must be addressed. Our adversaries, including both state and nonstate actors, are becoming more sophisticated and are actively attempting to degrade and deny our access. We must pursue innovative solutions that give us an advantage in both decision and agility. Additionally, the nation's fiscal constraints demand that government agencies make judicious decisions about where, why, and how every dollar is spent, resulting in increased emphasis on the affordability and efficiency of intelligence, surveillance, and reconnaissance (ISR).

A trend in the ISR environment is the increasing rate of commercial innovation and the resulting democratization of technology. This tendency offers a unique opportunity to integrate and leverage new and novel sources of information outside our span of control to guide the ISR capabilities within our span of control, obtain information in contested environments, and ultimately increase our enterprise-level affordability, efficiency, and effectiveness. Mobile targets and the dynamic threat landscape motivate the need for real-time intelligence, situational awareness, and decision making. After becoming the Air Force's first deputy chief of staff for ISR, Lt Gen David Deptula remarked that, today, "intelligence is operations."[28] The value of single-source intelligence is rapidly diminishing.

Opportunities remain to support efforts to gain efficiencies in sensing: Can SWaP-C of sensors and platforms be reduced to bend the cost curve and enable new applications via distributed sensing? How can the industry affordably, efficiently, and effectively leverage commercial, uncooperative, and nontraditional sources within the broader ISR enterprise? What cost-effective sensors and sources could be most transformed in intelligence value through exquisite algorithms and processing? How do we determine the optimal collection strategy to make inferences and reduce uncertainty about a specific activity? At some point, the community must ad-

dress the broader issues across the entire spectrum of doctrine, organization, training, materiel, leadership and education, personnel, facilities, and policy. Concepts of operations, system architecture, training, test, launch, transition, operator acceptance, operations and maintenance, command and control, tasking priorities, data paths, replenishment, upgrades, disposal, and so forth, are just a few of the many factors that must be considered during the engineering of space systems.

The outcome of further study across the community will inform what portions are feasible and those that are not practical. Both feasibility and nonfeasibility outcomes are critical so that time and effort are not spent on items of little return. Once feasibility has been determined, then more practical research and development can begin in earnest.

Success will demonstrate that CubeSats can add differentiated value in this critical area and support the missile defense war fighter. Target-signature detection and exploitation through use of CubeSat technology hosting hyperspectral sensing and/or multistatic payloads will directly benefit various sponsors, including the MDA, military, and other agencies. Although separate organizations may have different requirements, similar solutions may more efficiently offer coordinated support not only for space-based discrimination but also for space situational awareness and protection.

Research should continue to investigate and attempt to demonstrate the convergence of low-cost, overhead-deployment technology and low-power, lightweight payloads that could augment other systems. As with most emerging technologies, future development efforts will determine the true scope and utility of CubeSats to enhance and improve the nation's overhead architecture and assist the MDA's highest-priority mission in defending the homeland and forces assigned around the world from ballistic missile attack. ✪

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Dr. Barnes (BS, MS, PhD, Auburn University; MS, University of Alabama in Huntsville) has multiple years of experience in command and control and space-based processing with the Missile Defense Agency. He has contributed to several of the nation's critical ballistic missile defense programs, including Ground-Based Midcourse Defense; Command and Control, Battle Management, and Communications; and Terminal High Altitude Area Defense. A member of NASA's Alabama Space Grant Consortium, he also worked with Auburn University faculty members to implement a system engineering approach to the university's student space program. In addition to employment at the MITRE Corporation, Dr. Barnes instructs undergraduate and graduate courses at the University of Alabama in Huntsville.

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Multidomain Operations

A Subtle but Significant Transition in Military Thought

Dr. Jeffrey M. Reilly

On 17 November 2011, Gen Martin Dempsey, chairman of the Joint Chiefs of Staff, asked the Military Education Coordination Council the prophetic question, "What's after joint?"[1] After more than four years, that question remains ostensibly unanswered. The answer, however, may reside in the notion of multidomain operations.[2] General Dempsey's inquiry was spurred by the fact that historical approaches to achieving superiority in the air, land, and sea domains may no longer be valid. The principal factor driving this phenomenon is a global proliferation of advanced information technology. Although the United States has undergone dramatic changes in technology in the past, we are in only the nascent stages of understanding this era's monumental impact on future military operations. The worldwide flood of powerful, inexpensive, and readily available commercial technology is mandating a much more sophisticated approach to military affairs. The primary catalyst for this revolution has been the miniaturization of the transistor. In 1965 Gordon Moore observed that the number of transistors on integrated circuits doubles approximately every two years.[3] Transistors control the flow of electricity in a circuit, and the miniaturization of the transistor has enabled 20 billion of them to be emplaced on single wafer-thin computer chips no bigger than a fingernail.[4] Consequently, computer processing power has been doubling every two years and is expected to continue to the year 2020.[5] The exponential growth associated with Moore's Law has created a security environment where the pace of cyber, directed energy, nanotechnology, robotics, and biotechnology advancements is far beyond the normal capacity to predict their effects. Advanced information technology is also changing our perspectives of multidomain interdependence. America's ability to project conventional power abroad is eroding swiftly as state and nonstate actors acquire advanced capabilities to offset the US military's strengths across all operating domains—air, land, sea, space, and cyberspace.[6] Additionally, the requirement to think across domains is occurring at increasingly lower levels and will be essential in the future to generating the tempo critical to exploiting fleeting local opportunities for disrupting an enemy system.[7] These changes in the operational environment, combined with "new" fiscal realities, are rapidly transforming how we need to think about threats, the battlespace, and the conceptual underpinnings of airpower.

Multidomain Operations Are an Enduring Characteristic of Warfare

The concept of cross-domain operations is not new. It has been an inherent part of military thought since antiquity. The disastrous Athenian campaign to conquer Sicily during the Peloponnesian War provides just one example (fig. 1). In 415 BC, Athens launched an ill-advised expedition to subdue Sicily's strongest state, Syracuse. The Athenian force led by Nicias consisted of approximately 6,400 men and 134 ships. The Athenians enjoyed early successes; however, in 414 BC during the siege of Syracuse, the Spartan strategos Gylippus intervened and turned the tide of battle in favor of the Syracusan forces. Gylippus focused initially on the human domain, inspiring the Syracusan forces and galvanizing the support of their allies. He then embarked upon simultaneous attacks of the Athenian troops on the land and at sea. By 413 BC, the Athenians had been defeated.[8]

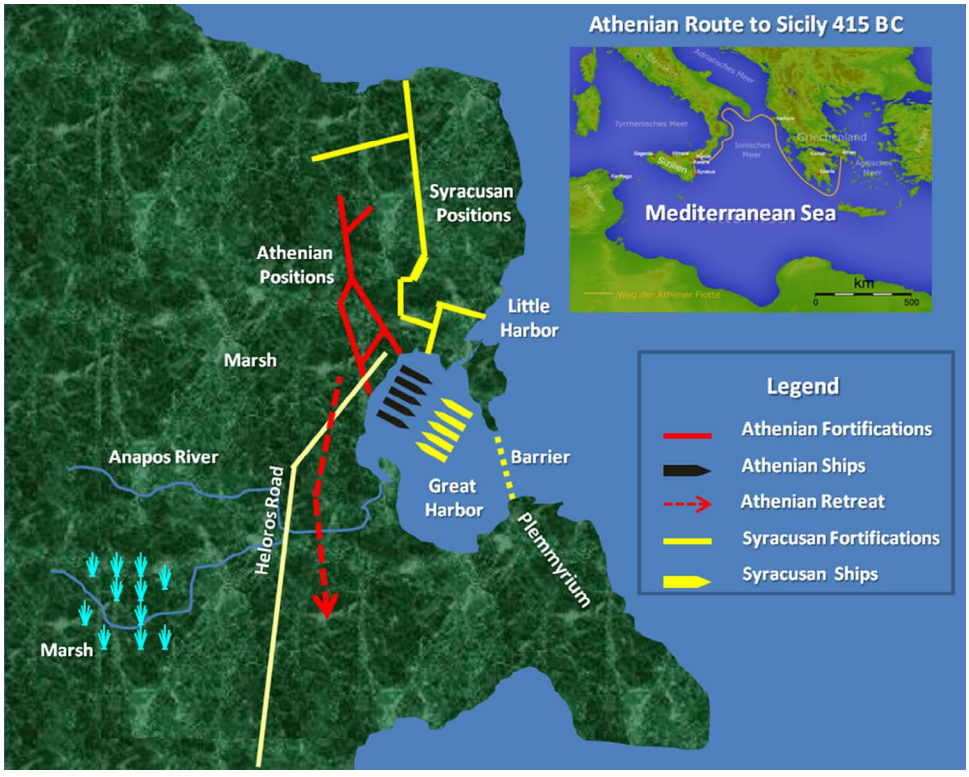

Figure 1. Athenian debacle in Sicily

This defeat signaled the beginning of the end for the Athenian empire. It created panic in Athens, caused a major shift in Athenian alliances, and paved the way for Sparta's final victory over Athens in 404 BC. However, the lesson of this historical example goes far beyond the collapse of Athens. It highlights the importance of under-

standing multiple domains and the necessity of shifting local superiority between domains. Gylippus and the Syracusan forces were not successful in all of their engagements. In fact, the Athenians defeated or repelled those forces at several key points in the campaign. Nevertheless, Gylippus concentrated on what is now becoming a crucial idea embedded in the Joint Operational Access Concept—specifically, that superiority in any domain may not be widespread or permanent but more often local and temporary.[9] Gylippus's comprehension of linking multiple domains and operating across domains was the intrinsic element in Syracuse's victory. The lesson from Gylippus is that establishing superiority in a combination of domains offers the freedom of action necessary to attain mission success.

Challenges of Future Technological Threats

As the US military embarks upon the chairman's Capstone Concept for Joint Operations, the emerging strategic landscape is revealing a wide array of new threats that is dramatically degrading the overwhelming asymmetric advantage we have enjoyed for the past two decades. Unable to compete with US forces directly, adversaries are leveraging technological advances to create their own asymmetric advantages in countering US military superiority.[10] Russia, Iran, North Korea, and China have invested in a number of ballistic and supersonic cruise missiles designed to challenge the United States' conventional superiority. China's DF-21D, a medium-range ballistic missile, reportedly possesses a maneuverable reentry vehicle, features terminal guidance based upon both the Global Positioning System and active radar, and can strike 1,500 to 2,000 kilometers (km) away from China's shores (fig. 2).[11]

At least nine countries are involved in the development and production of land attack cruise missiles, and many of these weapons will be available for export within the next decade.[12] Innovations in cruise missile technology have created supersonic threats that can engage targets 300 km away and be delivered by a variety of systems such as aircraft, submarines, ships, or even trucks.[13] Furthermore, modern cruise missiles can be programmed to approach and attack a target in the most efficient manner, allowing an adversary to fire multiple missiles and strike simultaneously from different directions, overwhelming air defenses at their weakest points.[14] Newer missiles are incorporating stealth features to make them even less visible to radars and infrared detectors, and they can be armed with conventional, air-fuel, or even low-yield nuclear warheads.[15]

In addition to threats from advanced missile technology, between 2004 and 2012, the number of countries having acquired remotely piloted vehicles increased from 41 to at least 76.[16] Many of them are seeking to enhance not only their intelligence acquisition but also armed strike capabilities.

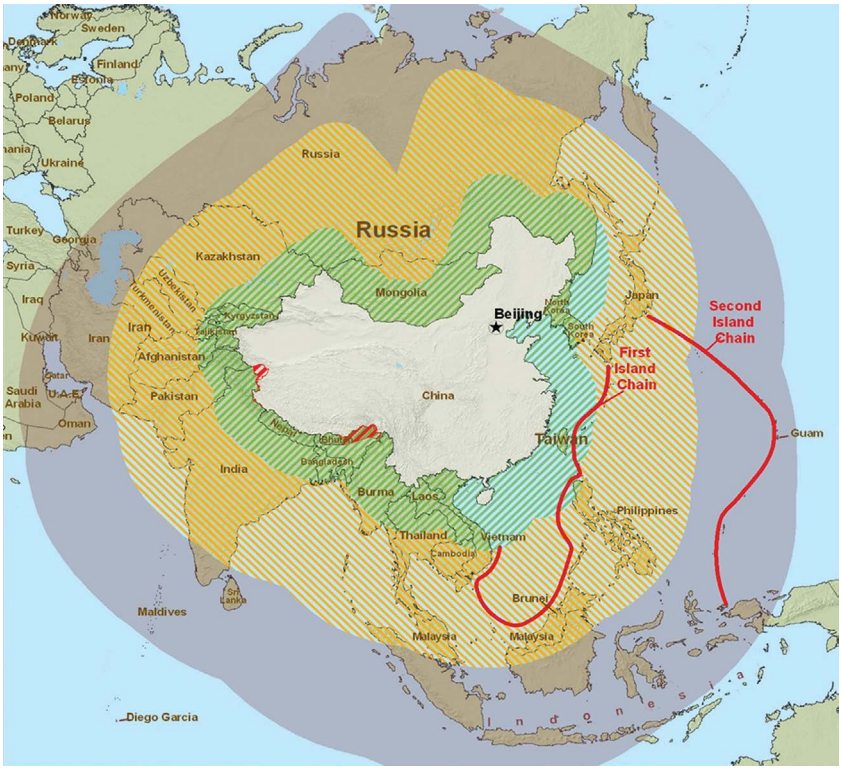

Figure 2. Conventional antiaccess missile capabilities of the People's Republic of China. (Reprinted from Department of Defense, Office of the Secretary of Defense, *Military Power of the People's Republic of China: A Report to Congress pursuant to the National Defense Authorization Act, Fiscal Year 2000* [Washington, DC: Department of Defense, Office of the Secretary of Defense, 2009], 23.)

Furthermore, numerous countries are working on high-powered microwave (HPM), directed-energy, and electromagnetic pulse (EMP) weapons (fig. 3). A 2005 declassified intelligence report on the bio-effects of Chinese EMP and HPM weapons indicated that China could detonate a low-yield, low-altitude strategic nuclear warhead to destroy electronic systems while minimizing the effects to the Chinese mainland.[17] The significance of this intelligence is that it sheds light on using weapons systems to deny multiple domains simultaneously. EMP damages unhardened electrical circuits and electronics by generating a surge in the current and voltage beyond normal functioning capacity. A 1-megaton nuclear blast detonated 400 km above the center of the United States can have continental-wide terrestrial effects in seconds, as well as a significant impact on space capabilities.[18] Take, for example, the United States' 1962 "Starfish Prime" nuclear test when a 1.4 megaton weapon was detonated 400 km above the earth's surface. The electromagnetic effects from the detonation not only reached Hawaii, 898 miles away, but also created an intense artificial radiation belt that began damaging orbiting weather and communications satellites. The artificial radiation belt destroyed seven satellites and per-

sisted until the early 1970s.[19] To place this in perspective, over 40 percent of the world's active satellites are in low Earth orbit. One should also note that adversaries can deliver effects from EMP through a multitude of nonnuclear modes that produce a wide array of outcomes ranging from temporary interference to system destruction. These modes include ballistic missiles, submarines, aircraft, and satellites as well as man-packed systems such as an explosively pumped flux compression generator.[20]

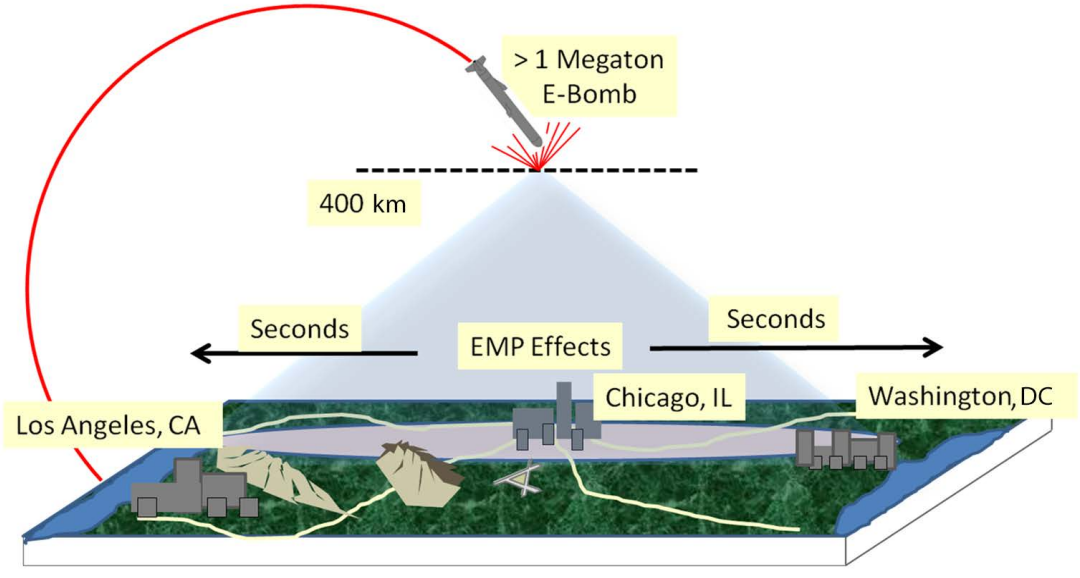

Figure 3. Effects of electromagnetic pulse. (Derived from Headquarters Department of the US Army, *Nuclear Environment Survivability* [US Army White Sands Missile Range, NM: US Army Test and Evaluation Command, 15 April 1994], appendix D.)

Advances in technology are also affecting an adversary's ability to defend itself. Integrated air defense systems are becoming increasingly resistant to electronic suppression through the use of passive sensor technologies such as infrared search and track. These technology leaps are being augmented with surface-to-air missiles that have advanced tracking and longer ranges. Potential adversaries are also investing in inexpensive low-power jammers to inhibit the positioning, navigation, and timing necessary for effective strike operations.[21]

Changes in Adversarial Concepts and Strategies

Although the military modernization of possible enemies is disconcerting, it is only part of the future threat equation. Prospective foes are combining advances in technology with operational concepts and strategies designed to deny the US military asymmetric maneuver in multiple domains. The People's Republic of China (PRC) is aggressively pursuing this path, combining what it refers to as *shashoujian*

(trump card or assassin's mace) technology with the concept of unrestricted warfare and an information warfare strategy. *Shashoujian* refers to a set of military capabilities that enables the technologically inferior to defeat the technologically superior. These capabilities include advanced integrated air defense systems, ballistic and cruise missiles, advanced strike aircraft, attack submarines, and counterspace capabilities.[22] A number of Chinese authors advocate going beyond the traditional boundaries of warfare, when necessary, to realize national political objectives. They propose using *shashoujian* strikes on a superior adversary's critical nodes to paralyze his forces and cause disintegration.[23] The following excerpt from Col Qiao Liang and Col Wang Xiangsui's book *Unrestricted Warfare* provides exceptionally sobering insight into the conceptual underpinnings of *shashoujian* and the concept of unrestricted warfare:

> Supposing a war broke out between two developed nations already possessing full information technology, and relying upon traditional methods of operation, the attacking side would generally employ the modes of great depth, wide front, high strength, and three-dimensionality to launch a campaign assault against the enemy. . . . However, by using the combination method, a completely different scenario and game can occur: if the attacking side secretly musters large amounts of capital without the enemy nation being aware of this at all and launches a sneak attack against its financial markets, then after causing a financial crisis, buries a computer virus and hacker detachment in the opponent's computer system in advance, while at the same time carrying out a network attack against the enemy so that the civilian electricity network, traffic dispatching network, financial transaction network, telephone communications network, and mass media network are completely paralyzed, this will cause the enemy nation to fall into social panic, street riots, and a political crisis. There is finally the forceful bearing down by the army, and military means are utilized in gradual stages until the enemy is forced to sign a dishonorable peace treaty.[24]

The recent exposure of the People's Liberation Army (PLA) Unit 61398 in Shanghai by the Mandiant cybersecurity firm highlights the PRC's ability and willingness to conduct cyber exploitation and cyber attack operations globally.[25] The PRC's well-publicized cyber capabilities go far beyond collecting and exploiting intelligence data. The difference between cyber exploitation and attack is as simple as a keystroke. The PLA is actively creating the strategic guidance, tools, and trained personnel necessary to employ computer network operations in support of traditional war-fighting disciplines.[26] Cyberspace offers the PRC and other state and nonstate actors the capacity to delay an adversary's response to a kinetic attack by implanting malicious code in advance on the enemy's logistics; command, control, communications, computers, intelligence, surveillance, and reconnaissance; and commercial support networks.[27]

In spite of the significant advantages that China enjoys from cyberspace, it is not the focal point of the PRC's information warfare strategy. The PLA's assessments of current and future conflicts note that campaigns will be conducted in all domains simultaneously but that its emphasis on the electromagnetic spectrum has driven the PLA to adopt a much more comprehensive approach.[28] In 2002 the PLA's Maj Gen Dai Qingmin characterized electronic warfare as an intangible power necessary for success. He pointed out that whichever side loses in an electronic war will be reduced to blindness and deafness, so its weapons will be disabled, and it will lose its initiative in a battle, campaign, or even an entire strategic situation.[29] PRC writings emphasize that electromagnetic dominance in the early phases of a cam-

paign is one of the foremost tasks to ensure battlefield success. The Chinese strategy known as integrated network electronic warfare combines electronic warfare, computer network operations, and kinetic strikes to disrupt battlefield information systems that support an adversary's war-fighting and power-projection capabilities. This type of warfare also stresses that the electromagnetic spectrum is a vital fourth dimension equally as important as traditional ground, sea, and air forces.[30]

China's military modernization and strategy are a harbinger of a broader trend in which smaller regional powers and even nonstate actors are seeking to develop or procure asymmetric capabilities that are changing the traditional notion of military operations.[31] For the United States, the implications of this phenomenon are numerous and serious enough to mandate another look at how we educate future Air Force leaders to develop, coordinate, and execute air operations. One of the most dynamic implications is the shift in conceptualization of the battlespace and its impact on the homeland, space, and the electromagnetic spectrum.

Implications for the Concept of the Battlespace

Advances in technology have subtly nudged the entire globe into a realm where all previous notions of the battlespace have been radically altered by domain interdependence driven by a combination of factors ranging from advanced technology efficiency to fiscal constraints. These factors are creating an environment where failure in one domain has cascading effects in one or more of the others. Postmodern technology is quickly fusing a continuum of integrated and interdependent domains. Figure 4 provides a simplistic illustration of this continuum. In this construct, the electromagnetic spectrum (EMS) empowers space, allowing it to supply key enablers for the domains of air, land, and sea, in turn facilitating the ability to influence or control the human domain. Hypothetically, if an opponent attacks or manipulates the use of radio frequencies within the EMS, through cyber or other means, he could deny access to vital satellites that we rely on for intelligence, surveillance, and reconnaissance; communications; early warning; and navigation. The consequences would severely affect a joint force air component commander's planning, decision, and execution cycle and could render operations in the air, on land, and at sea ineffective. Future Airmen must be sufficiently cognizant of this integrated operational environment to ensure that enough local superiority in the right combination of domains fosters the conditions necessary for operational success.

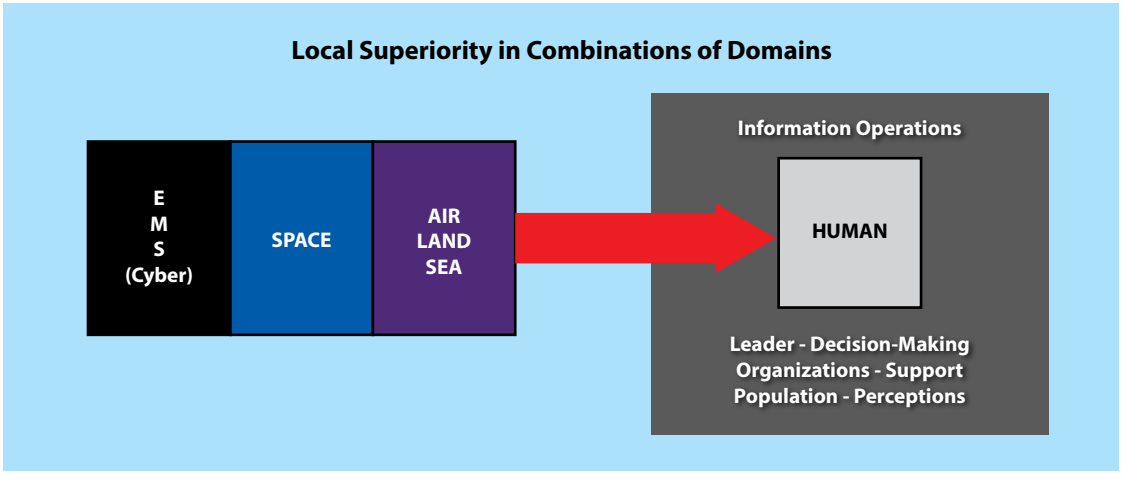

Figure 4. Continuum of domains and their interdependence

It is also important to emphasize that the transformation of the battlespace is much more significant than challenges related to operating in a highly contested EMS within a designated joint operations area. For the first time since the end of the Cold War, the United States faces the threat of a catastrophic attack on the homeland beyond the scale of the terrorist strikes of 11 September 2001. The historical barriers of the Atlantic and Pacific oceans are no longer effective means to negate an enemy's operational reach. The simple arrangement of 1s and 0s traveling at the speed of light can transmit computer packets of information to US homeland systems via a radio frequency signal almost instantaneously. Furthermore, these information packets can be pre-positioned and lay dormant within systems well prior to any attack without prior detection. The continuing growth of networked systems, devices, and platforms offers prospective state and nonstate foes a plethora of vulnerabilities to threaten US national security that go well beyond military targets. The integrated nature of cyberspace in the realm of power grids, transportation networks, communications, and financial systems represents a lucrative target that would allow an adversary to cause massive physical damage and economic disruption to the US homeland.

Since 2006 the unauthorized access to and installation of malicious software on US government computers have increased by 650 percent.[32] Moreover, the Department of Homeland Security reported 198 cyber attacks on critical US infrastructure during 2012—a 52 percent increase over those that occurred in 2011.[33] A five-year-old National Academy of Sciences report, declassified and released in November 2012, found that physical damage by terrorists to large transformers could disrupt power to large regions of the country and could take months to repair.[34] Furthermore, this type of attack could be carried out with little risk of detection or interdiction. As a reference point, the largest power blackout in North American history took place on 14 August 2003 when four sagging high-voltage power lines in northern Ohio brushed into some trees. A computer system error further complicated the

accident.[35] This incident left 50 million people across the United States and Canada without power, cost $6 billion to repair, and may have contributed to 11 deaths. Given this example, it is not hard to imagine a determined adversary simultaneously attacking combinations of critical infrastructures such as the electric grid, pipelines, communications, transportation, and financial networks. The devastation would be incalculable. In his book *America the Vulnerable*, Joel Brenner estimates that it would take two years to replace the heavy-duty generators that supply electricity to large cities.[36]

Another significant change in battlespace is space. Since 1991 the United States has become more reliant on space-based capabilities to support military operations. Space assets provide the means to communicate globally; conduct the positioning, navigation, and timing necessary for precision strikes; and empower enhanced intelligence, surveillance, and reconnaissance. Further, space furnishes virtually unimpeded overflight access to conduct the monitoring essential for missile-launch detection, missile tracking, and early warning. Opponents clearly recognize space's intrinsic role as a US force multiplier, and they also possess an understanding of its considerable vulnerabilities.

A satellite system consists of three basic components: the satellite itself, the ground stations used to command and control it, and the communication links between the components. All of the latter have varying degrees of vulnerabilities. Satellites themselves are nearly impossible to hide. They move along predictable paths, are visible to observers over large swaths of the earth, and can appreciably change their orbit only with significant effort. Adversaries can employ a variety of attack options, including kinetically striking the ground stations, jamming or spoofing links, and using directed energy to dazzle or partially blind the satellite. On a more revolutionary level, future enemies could theoretically use "parasitic microsatellites" that could latch onto a satellite and disable it, alter its orbit, or hijack the information gathered by it.[37]

The principal concern today is the rapid acceleration of the militarization and weaponization of space. On 11 January 2007, the PRC conducted its first successful direct-ascent antisatellite weapons test, launching a ballistic missile armed with a kinetic-kill vehicle to destroy the Fengyun-1C weather satellite at about 530 miles up in low Earth orbit.[38] China followed up in 2010 and 2013 with additional antisatellite tests. On 13 May 2013, it fired a missile into space that reached an altitude of over 6,000 miles and possibly over 20,000 miles.[39] This range could allow China to attack US Global Positioning System and military and intelligence satellites in medium and high Earth orbits. Antisatellite missiles, however, are far from the only threat to the US military's use of space. Space-based capabilities are dependent upon the EMS for effective operations since it provides the sole medium for transmitting and receiving information and signals in space.[40] Additionally, the frequency bands that space-based systems use within the spectrum are fixed and cannot be changed after launch.

The EMS is a physics-based maneuver space that is essential to control the operational environment during all military operations.[41] The spectrum represents the range of wavelengths or frequencies over which electromagnetic radiation extends. It encompasses the use of electromagnetic radiation associated with radio, microwave,

infrared, visible, ultraviolet, X-rays, and gamma rays, exerting a dominant influence on all domains. The EMS is crucial for communications, command and control, blue force tracking, precision attack, and a host of other joint functions used every day and commonly taken for granted. Furthermore, the Department of Defense has invested billions of dollars in developing, maintaining, and employing war-fighting capabilities that rely on access to the EMS.[42] The projected investment for the development and procurement of fixed-wing airborne electronic attack systems alone in 2007–16 is more than $17.6 billion.[43]

Like space, the EMS is exceedingly complex. One of the key constraints of this battlespace is that only 1 percent of the spectrum accounts for 90 percent of its military and civilian use. The effectiveness of the EMS is also complicated by electromagnetic interference between systems, EMP, competition between military and civilian use, and natural phenomena such as lightning, solar flares, and precipitation. Additionally, it is important to emphasize that our adversaries know and understand the EMS and that they will aggressively contest our access to it. Use of the spectrum requires coordinated, prioritized, and deconflicted operations. Supported joint force commanders hold the authority for assigning frequencies to users, and once frequencies are allocated to systems within a specific geographical area, they are no longer available for use This fact necessitates that commanders and their staffs understand how to operationally assess the impact of forfeiting the use of spectrum-dependent systems in order to employ other capabilities.

The international environment further obscures effective use of the EMS in support of military operations. The spectrum transcends all physical domains, has no specific or internationally recognized boundaries, and can create a wide array of unintended collateral effects ranging from the annoyance of a communication disruption to a deadly collision on a civilian railway transit system. Accordingly, approval to use electromagnetic-dependent systems for military operations calls for extensive coordination with multinational allies and host nations. It also mandates an innovative level of operational planning that facilitates prioritized allocation of bandwidth, efficient data exchange, flexible security requirements, and the organizational processes necessary to support the operation.

How Does This Change in Operational Environment Affect Airpower?

The dramatic alterations now occurring across the operational environment will affect airpower in innumerable ways, including air superiority, strategic attack, counterland, countermaritime, and support to special operations forces. However, the two most significant effects will involve planning, decision, and execution cycles and domain superiority. In the future, these cycles will be compressed, reachback capabilities will be limited, and forward commanders will have to rely on mission-type orders because the EMS will be vigorously contested and because both terrestrial and space-based communications will suffer degradation or disruption. Consequently, airpower's foundational principle of centralized control / decentralized execution will be forced to shift to a distributed-control approach that adapts to

operational changes by having preplanned bandwidth allocations and a vision for maneuvering between gateways.

The impending operational environment will also influence the concept of domain superiority. As advanced technology continues to proliferate, domain superiority will be much harder to achieve. In fact, such superiority will most likely remain localized and temporary. Moreover, it is important to point out that success may not depend upon the traditional quest for domain superiority. Instead, success may reside in precision access in a single domain that enables a combination of actions in other domains. Airmen must become much more attuned to forms of maneuver in all of these realms, and until they develop an appreciation for and understanding of multidomain maneuver, true innovation in airpower, unfortunately, will be lacking.

Conclusion

When General Dempsey asked, "What's after joint?" he was emphasizing that at some point in time, the focus on joint operations will not be adequate to address the challenges of our emerging operational environment. During the past two decades, airpower has given the joint force unrivaled dominance in the air. However, quantum advances in technology and the realities of fiscal constraints are driving a dynamic era of evolutionary adaptation. This evolution must be deliberately shaped to ensure that domain interdependence does not inadvertently risk a single point of failure. More than ever before, Airmen must have a clear and common understanding of simultaneous maneuver in multiple domains beyond air, space, and cyberspace. ✪

Notes

1. The Military Education Coordination Council serves as an advisory body to the director of the Joint Staff on joint education issues. The council's principals are the Deputy J-7, the Deputy Director Joint Staff-Military Education; the presidents, commandants, and directors of the joint and service universities and colleges; and the heads of any other institutions accredited by joint professional military education.

2. Currently, no doctrinal definition of *domain* exists. This analysis defines the term as a critical sphere of operational influence whose control provides the foundation for freedom of action. Cross-domain operations involve the exploitation of asymmetric advantage across multiple domains to achieve the freedom of action required by the mission.

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18. Headquarters Department of the US Army, *Nuclear Environment Survivability* (US Army White Sands Missile Range, NM: US Army Test and Evaluation Command, 15 April 1994), appendix D.

19. See Chuck Hansen, *U.S. Nuclear Weapons: The Secret History* (Arlington, TX: Aerofax, 1988), 78–79 and 81.

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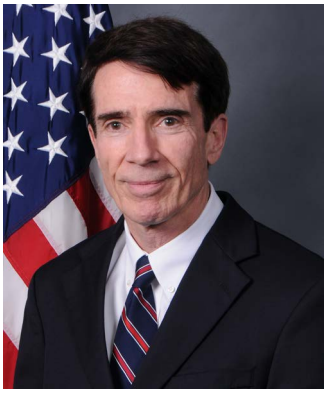

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Geopolitics and Planning for a High-End Fight

NATO and the Baltic Region

Dr. Ralph S. Clem*

This article would'The author wishes to thank two anonymous reviewers of an earlier draft of this article for their insightful and very helpful comments. The author is solely responsible for any shortcomings

In a remarkably brief period, a serious challenge to the national security interests of the United States and its allies has emerged in Europe. This new threat emanates from a militarily resurgent and increasingly aggressive Russia, openly manifested in early 2014 by its seizure of Crimea from neighboring Ukraine—the first time since the end of the Second World War that a European state has annexed territory from another European state. The subsequent spread and intensification of Russian-sponsored fighting to regions of eastern Ukraine, including the direct engagement of Russian military units, have had catastrophic consequences, with thousands of military and civilian deaths, hundreds of thousands of internally displaced persons, and widespread damage to infrastructure. Compounding this ongoing conflict is a dramatic increase in Russian Air Force activity in airspace adjacent to North Atlantic Treaty Organization (NATO) countries, including long-range patrols in the Atlantic and Pacific oceans as well as an ever more ambitious cycle of combined-arms military exercises by the Russian armed forces on a scale not seen since the collapse of the Soviet Union in 1991. Given these events, one must recognize that *at the extreme*, the possibility of armed conflict between the Russian Federation and NATO exists to a much higher degree than has been true since the end of the Cold War.

This article argues that the dynamic risk presented by Russia requires NATO air forces in general and the US Air Force in particular to adapt quickly to these evolving strategic and tactical realities. One key element in planning for air operations against a technologically advanced adversary such as Russia is to consider the best locations from which to fight, a question that impinges directly on the effectiveness and survival of NATO air units. Accordingly, this study begins by describing the geopolitical background of the current heightened tensions between NATO and Russia and then focuses on how this increasingly fraught situation relates to defending the alliance's most vulnerable member states: the three Baltic countries of Estonia, Latvia, and Lithuania.[1] The analysis then considers forward-basing options for NATO air

force units, including those proposed in recent studies, in light of known threats and the realities of military geography.

NATO and the New Russian Threat

To appreciate the suddenness with which Russia has emerged on the scene as a real geostrategic opponent for the United States, one should consider the 2012 Defense Strategic Guidance (DSG).[2] Catherine Dale and Pat Towell note that this document is "explicitly intended to reshape future Department of Defense (DOD) priorities, activities, and budget requests for the following decade."[3] In the section that assesses the present and future global security environment, the DSG overwhelmingly emphasizes the "*rebalance toward the Asia-Pacific region*" (emphasis in original), the clear implication of which is to give US military capabilities in Europe less prominence (although this is couched in language crafted to obscure that fact).[4] Notably, given subsequent developments to the contrary, the same portion of the document declares that "our engagement with Russia remains important, and we will continue to build a closer relationship in areas of mutual interest and encourage it to be a contributor across a broad range of issues."[5] Yet, by 2014 Robert Legvold, the respected scholar of Russian foreign policy, having taken note of developments after 2012, would write that "the crisis in Ukraine has pushed the two sides over a cliff and into a new relationship, one not softened by the ambiguity that defined the last decade of the post–Cold War period, when each party viewed the other as neither friend nor foe. Russia and the West are now adversaries."[6] Finally as an indication of how dramatically things have changed in terms of US national security interests since 2012, in his confirmation testimony before Congress in July 2015, Gen Joseph Dunford, the current chairman of the Joint Chiefs of Staff, stated that he viewed Russia as an "existential threat to the United States," ahead of all his other concerns, including China, North Korea, and the Islamic State.[7] Subsequent to General Dunford's testimony, Russia's military intervention in Syria has no doubt underscored that view.

Although numerous analyses have addressed Russia's motives in undertaking these moves, this article contends that appropriate responses by the United States and its NATO allies deserve more emphasis, especially as regards planning for air operations against such a highly capable opponent. Indeed, given the instability in many regions of the world and the proliferation of sophisticated weapons systems, the DSG calls for the United States to develop further its ability to project military power into areas where technologically advanced defenses make such operations risky—what have become known as antiaccess/area-denial (A2/AD) environments. In this regard, the only two such A2/AD states specifically mentioned in the DSG are China and Iran.[8] Russia, however, is very definitely an A2/AD state—one that actually has contiguous borders with five NATO member states and is relatively close to several others. This geographical fact, discussed in detail below, presents some unique complications for military planners, especially concerning the NATO Baltic region.

Stephen Walt convincingly argues that the aggressive foreign policy and military actions of Russian president Vladimir Putin against some of his neighbors handed a declining and drifting NATO a revived raison d'être that especially benefits the Baltic member states, which have eagerly sought this kind of attention from the alliance—particularly as the Russian threat has become more of a reality.[9] If Russia's war against NATO-aspirant Georgia in 2008 was not enough of a harbinger, certainly Moscow's more recent attacks in Ukraine and the much higher operational tempo of Russian forces along NATO's eastern frontier have energized the alliance, with the focus on defending the highly exposed Baltic region. President Barack Obama made that clear during his visit to the Estonian capital, Tallinn, in September 2014, where he affirmed NATO's commitment under Article 5 of the North Atlantic Treaty to come to the defense of the Baltic countries.[10] This theme was enhanced and operationalized at the NATO Wales Summit that followed the president's Tallinn remarks. There, NATO leaders approved a readiness action plan that

> include[s] measures that address both the continuing need for assurance of Allies. . . . [Said] assurance measures include continuous air, land, and maritime presence and meaningful military activity in the eastern part of the Alliance, both on a *rotational* basis . . . and the [establishment] of a Very High Readiness Joint Task Force (VJTF) . . . that will be able to deploy within a few days to respond to challenges that arise, particularly at the periphery of NATO's territory (emphasis added).[11]

This forward-leaning posture vis-à-vis NATO's defense of the Baltic region is encouraged by strong support for such a strategy by, among others, NATO, the Baltic countries themselves, the US government, and some parts of the national security community in this country.[12] In turn, this new strategic direction stimulates demands from the alliance's political leadership on NATO's military establishment to provide operational (i.e., tactical) plans to deter Russian aggression and, if that fails, to carry out an actual military response. From the first of these new requirements has emerged the VJTF and a series of exercises involving units assigned thereto; an enhanced Baltic air policing mission that monitors and in many cases intercepts Russian military aircraft operating in the region; and, for US forces specifically, a number of deployments and exercises under the rubric Operation Atlantic Resolve.[13] These latter include US Air Force units deploying from the continental United States (CONUS) to European bases as theater security packages as well as United States Air Forces in Europe (USAFE) units operating from forward bases, including Ämari in Estonia and Šiauliai in Lithuania, for various exercises or to take up Baltic air policing rotations. Further US commitments to bolster the confidence of the Baltic countries have been forthcoming via the European Reassurance Initiative announced by President Obama in June 2014, which includes, among many other items, funds for improvements at Ämari, Šiauliai, and Lielvārde (in Latvia) airfields (and at Łask Air Base in Poland).[14] More recently, Secretary of Defense Ashton Carter announced in June 2015 that the United States would begin temporarily prepositioning equipment for an armored brigade in central and eastern European NATO countries, with each of the Baltic states agreeing to host company- to battalion-sized elements, thereby facilitating the rotation of American forces into the region for training and exercises.[15] Finally, in August 2015, the US Air Force dispatched

F-22 Raptors to Europe for the first time, officially "to train alongside other U.S. Air Force aircraft, joint partners, and NATO allies," but the geopolitical message sent by the deployment surely did not go unnoticed in Moscow.[16]

Considering a High-End Fight with Russia

Since many countries now possess technologically advanced air defense systems, the critical need to develop and exercise ways to engage potential enemies in what has been termed a "high-end" fight is undeniable. Emphasizing "that the Nation relies on [the Air Force] to be first in for the high-end fight," the service's senior leadership has on numerous occasions stressed the urgency of enhancing readiness and training to the demanding standard necessary to prevail in such conflicts.[17] If it comes to that, a war against Russia would certainly be a high-end fight from the outset. The sweeping force-modernization programs undertaken by Russia have continued and will continue to significantly up the ante in terms of any military confrontation with that country in the Baltic region (or elsewhere), including the use of NATO airpower. As Michael Kofman notes, "Russia is militarily the strongest it has been since the Cold War, fielding the most capable, modernized, and well-funded force it is likely going to have for the foreseeable future."[18] Such game-changing offensive and defensive technologies demand innovative thinking about the conduct of complex air operations. On the one hand, if anything, the imperative to be creative when it comes to the actual employment of airpower has increased over time, and the pace of such change necessitates continuing debate about how to adapt to more challenging threat scenarios. On the other, as discussed below, one must take care to place any military innovation—whether technological or operational—in the geographic context of where a potential conflict might become a reality.

From both a strategic and an operational perspective, a key aspect of planning options for the employment of land-based airpower is the obvious need for airfields from which to fight. Typically, air forces are concentrated at top-tier airfields (main operating bases [MOB]) with such features as permanent maintenance and refueling facilities, munitions storage, perhaps hardened and dispersed aircraft shelters or revetments, combat support or combat-enabling functions (such as intelligence and operations staff), and at least some provision for air base defense (depending on the proximity to the enemy). Because of the high cost of maintaining MOBs—and in certain cases, political sensitivities to their presence—these bases tend to be relatively few in number and therefore present an adversary with a short and easy-to-locate target list.

One concept that would mitigate the downside to the limited number of MOBs involves planning to spread air assets to other, secondary airfields and carry on the fight from there. During the Cold War, the epitome of this approach was USAFE's collocated operating base system wherein about two-thirds of units deploying from the CONUS would bed-down at airfields widely dispersed across NATO countries (especially the United Kingdom and Germany) with pre-positioned fuels and munitions.[19] More recently, two journal articles have offered interesting proposals to take the agile-basing model one step further by untethering operations from geographi-

cally fixed support elements (other than runways and parking) by refueling and rearming aircraft from mobile support teams airlifted into what otherwise could be a bare base (forward arming and refueling points [FARP]).[20] Both of these articles focus on situations in which US Air Force assets (principally fighter aircraft) would be deployed in an A2/AD scenario wherein the threat to MOBs would be high, one involving conflict with China and the other against Russia. Ideas such as the FARP initiative make very good sense and might be crucial to success in such situations, allowing in-place NATO forces to counter an aggressor (e.g., Russia) at least until additional assets flow from mobilizing units in European countries and active, Guard, and Reserve units from the CONUS.

How Far Forward Is Forward?

Indeed, one of the above-referenced articles posits a FARP operation at Ämari Air Base in Estonia, which is worth examining in light of the realities of military geography and the capabilities of opposing forces in a NATO-Russia conflict in the Baltic region. In other words, the question raised here is not *how* a high-end fight with Russia should take place if it comes to pass but *where* it should occur. More generally, analyzing this particular FARP scenario in its actual context may facilitate making sound decisions on basing that take into account the full range of factors involved.

The first of these factors is geography, which has dealt the Baltic countries a tough hand to play when it comes to national defense. The three NATO states in the Baltic region combined have about the same area and population as the state of Missouri. Further, Estonia and Latvia border Russia proper whereas Lithuania borders the Russian exclave of Kaliningrad (see the map on the next page). These basic facts of small geographic size and population and their precarious location, especially as it relates to Russia, have shaped the history of the Baltic countries and are crucial to understanding their present-day geopolitical situation. For our purposes in this section, the key point is that this reality renders them highly vulnerable to attack by a variety of means from their powerful neighbor to the East—so vulnerable that even agile, untethered air operations from the territory of the Baltic countries would be extremely risky and require, at a minimum, a level of defensive protection that, given the scarcity of such systems, could be better utilized elsewhere.

Courtesy of the University of Texas Libraries, the University of Texas at Austin, http://www.lib.utexas.edu/maps/europe/balticseaarea.jpg

Several specific threats to air operations would apply to air bases *regionwide* should the Baltic countries be attacked by Russia; they are, in declining order of importance, short-range ballistic missiles, air attack with standoff air-to-surface munitions, surface-to-air missiles, ground attack, and attacks by airborne or special operations

forces. Further complicating the threat picture, of course, is the strong likelihood that several of these attack modes might present themselves simultaneously or nearly so. Finally, the relative paucity of FARP-capable airfields in the Baltic countries restricts the options for such operations and reduces the enemy's target list to more manageable numbers. If one follows Lt Col Robert Davis's criteria for minimum FARP operations—and admittedly absent firsthand knowledge—there appear to be only three candidate airfields in Estonia, five in neighboring Latvia, and another five in Lithuania.[21]

Regardless of the number of possible FARP dispersal bases in the NATO Baltic region itself, all are highly problematic in terms of survival in a conflict with Russia. Without doubt the most significant threat to conducting NATO air operations from Baltic-region bases is the Russian Iskander short-range ballistic missile (NATO: SS-26 Stone). Robert Farley places the Iskander at the top of his list of the most serious threats that Russia presents to NATO—and with good reason.[22] The system is road-mobile and capable of operating independently; moreover, with a range of up to 250 miles, the missiles could strike all possible Baltic FARP bases from launchers inside Russia proper or in Russia's Kaliningrad exclave.[23]

Baltic-region airfields from which FARP operations might be conducted are also at risk from attack by the Russian Air Force—in particular, the SU-24 (NATO: Fencer) strike aircraft and variants of the Sukhoi family of multirole fighters (NATO: Flanker and Fullback) employing precision or unguided air-to-surface ordnance from the large variety of this type of weapon available in the Russian inventory. NATO's defensive counterair would be complicated by the short distances involved; for example, an SU-24 flying a low-altitude attack profile at speed would be overhead Ämari Air Base just 10 minutes after crossing the Russo-Estonian border. Additional threats to NATO aircraft operating in the Baltic region come from the increasingly more effective and longer-range Russian surface-to-air missile (SAM) air defense systems, especially the S-300 (NATO: SA-10 Grumble) family and the newer S-400 (NATO: SA-21 Growler). These mobile SAMs, if deployed inside Russia's western frontier, could acquire and engage aircraft over the eastern half of Estonia and Latvia, with the longer-range variants capable of covering virtually all of both countries, especially against a target with a large radar cross section (such as the C-17 in the FARP scenario). Further complicating NATO's challenges from Russian air defenses in the Baltic region is the huge military buildup in the Kaliningrad exclave, which may include batteries of the S-400 that could engage NATO aircraft operating from Šiauliai (the original and main Baltic air policing base) or other air bases in Lithuania or even eastern Poland.

Although greatly reduced in size by a series of military reforms in the post-Soviet period, Russia's ground forces can still endanger its much smaller neighbors, in particular the Baltic states. Depending on demands elsewhere, the Russian Army could bring to bear between two and six motorized rifle brigades along its western frontier with Estonia and Latvia, a force sufficient to challenge NATO's ability to ensure the safety of the few airfields in the region from which operations might be conducted. Should these formations penetrate any significant distance into Estonian or Latvian territory, they would bring with them the dense SAM defenses organic to Russian Army maneuver units, rendering air operations in the vicinity even more dangerous.

Finally, special operations forces (in Russian, *Spetsnaz*) and airborne troops have assumed a much more central role in Russian military planning. As their adroit employment in the seizure of Crimea demonstrated, these forces are capable of rapid, stealthy, and effective operations. One could reasonably expect that at least one *Spetsnaz* brigade would be available for operations against NATO in the Baltic region, as well as one regiment of airborne / air assault troops. It would also be prudent to assume that, given Russia's long and close involvement in the Baltic region and the presence there of a million ethnic Russians, its foreign and military intelligence agencies have more than adequate knowledge of the NATO military posture in that area.

Ultimately, in the calculus of military capabilities of NATO allies and possible adversaries in the Baltic region, the NATO Baltic states possess insufficient military strength with which to defend themselves against an attack from Russia.[24] The armed forces of the three Baltic countries include no tanks, no combat aircraft, and only short-range SAMs. What Luis Simón characterizes as "the lack of conventional military balance against Russian power" on the part of the Baltic countries propels the geopolitical anxiety manifest in the NATO Baltic states now that Russia presents a bona fide and growing threat to the survival of those countries.[25] Indeed, as Stephen Blank details, in the huge *Zapad* ("West") 2013 exercises, Russian military forces conducted "classic large-scale conventional theater operations involving combined and joint operations" in a scenario involving the Baltic region.[26] For the time being, the facts of geography and the potential threat from Russian forces render the forward deployment of NATO air assets into bases in that region perilous indeed in the event of hostilities between the alliance and Russia.

Conclusion
Airpower and Geopolitical Angst in the NATO Baltic States

The foregoing dire threat situation to the NATO Baltic states presented by the Russian armed forces raises the following question: why even think about fighting from there? The answer lies in the realm of geopolitics and especially in the accession of the Baltic states to NATO. After two centuries of Russian rule during the czarist era and harsh decades under the Soviet regime (with a period of independence between the two world wars truncated by forced annexation into the USSR, followed by mass deportations and significant loss of life), it comes as no surprise that the Baltic countries have serious national security concerns and that these concerns would center around their relationship with Russia. Once the USSR dissolved, all three newly independent Baltic states had to work out bilateral arrangements with post-Soviet Russia in the areas of economic linkages, citizenship issues regarding ethnic Russians desiring to remain in the region, withdrawal of Russian (former Soviet) military personnel, and questions of territorial delimitation. None of these went smoothly, and tensions between the Baltic countries and Russia inevitably resulted, further underscoring the need for these fledgling states to integrate themselves into the emergent European Union and into the best collective security option available: NATO. After joining NATO's Partnership for Peace in 1994 as a

precursor to full membership, the Baltic countries pushed aggressively for accession, having to counter the belief that their small size and lack of military capability would be seen as a liability for the alliance and that because of "their geographic position, they would be *impossible to defend*" (emphasis added).[27] They proved their bona fides by volunteering troops to Balkans peacekeeping operations, organizing their own regional defense collaborations, and continuing to press their case diplomatically until achieving their goal of full NATO membership in 2004. Not resting on those laurels, since accession, all of the Baltic countries have participated to the fullest possible extent in NATO exercises and out-of-area deployments, including the wars in Iraq and Afghanistan.[28]

One of the key manifestations of NATO membership for the Baltic countries has been the establishment and expansion of NATO air operations in the region. Immediately upon formal accession of the Baltic states to NATO, the alliance initiated the Baltic air policing mission at Šiauliai, said mission involving the rotation of fourship fighter packages from different NATO air forces to provide quick-reaction-alert capability over Baltic regional airspace. In 2014, in response to the Crimean crisis, the alliance quadrupled the number of fighter aircraft involved and added air bases in Estonia (Ämari) and Poland (Malbork) as part of this mission. Even though the number of aircraft was later trimmed, with heightened tensions between NATO and Russia from early 2014 on, the number of Baltic air policing quick-reaction-alert sorties increased dramatically as Russian air activity over the Baltic intensified, and NATO added supporting Airborne Warning and Control System patrols with its own and national aircraft.[29] Furthering the commitment on the part of NATO to vigorously defend its Baltic member states, a wide range of military exercises in the region (e.g., Saber Strike) is ongoing and increasingly larger and more complex. Most of these now have an air component, and some—such as the Baltic Regional Training Events—include upgraded exercising in close air support, interoperability, and command and control, all of which would be crucial for a multinational force in a high-end fight.[30]

This very high level of NATO air activity in eastern Europe no doubt pays a number of dividends, certainly offering realistic joint training in areas where hostilities might occur, hopefully deterring a potential aggressor, and showing the flag to allies. But one danger in all of this is that rotating aircraft to bases in the Baltic countries creates the impression that NATO air forces might choose to actually fight from there if the present crisis (or some future crisis) escalates into hostilities with Russia. As described above, even with options such as the FARP plan, should such circumstances unfold, air bases in the Baltic countries themselves would almost certainly prove unusable at best. To plan air operations under these conditions, whether agile or not, involves exposing precious resources and lives to an untenable risk until the threat from Russian attacks is greatly reduced.

If the Baltic countries are not the place to forward-base air assets in a conflict with Russia, then where would that place be? Poland appears the better option for FARPs in such a scenario. In addition to Polish Air Force MOBs, that country includes some 50 FARP-capable airfields. Poland is about 80 percent larger in area, having a population over six times the size of the NATO Baltic region, and its border with Russia is only along the Kaliningrad exclave (see the map above). Although the

frontage with Kaliningrad is not insignificant by any means, certainly one of NATO's highest priorities in any conflict with Russia would entail neutralizing Moscow's forces in the exclave. Poland's large and well-equipped army and a first-rate combat air force, with NATO reinforcements arriving in short order, would be vital to such a task. That this latter course may be what NATO is actually thinking is evidenced by the first VJTF exercise involving actual movement of troops (Noble Jump), wherein these rapid-reaction forces deployed to westernmost Poland.[31] With Kaliningrad neutralized, NATO air forces could be employed to counter any Russian moves across the Estonian and Latvian borders, perhaps in the meantime retarding Russian ground forces with interdiction missions from air bases in southern and western Poland or other Central European countries.[32]

The pressure brought to bear on NATO planners by the alliance's political leadership to devise ways to defend the Baltic region against a Russian invasion is intense, even in light of a good counterargument that such an invasion would not be in Moscow's best interest.[33] Regardless, such a defense is almost certainly not realizable in the short term. Forward-basing US and other NATO air units into those countries if hostilities were either imminent or under way, given the realities of military geography and the balance of forces in the region, would be imprudent to say the least. These realities certainly do not invalidate the FARP concept; rather, as noted above, this might be a very effective way to engage an enemy in a high-end fight, but it demands that planners consider carefully the geographic constraints dictated by the threat. Put another way, it would be unwise to allow strategic views emerging from geopolitical considerations to determine tactical planning for a high-end fight. ✪

Notes

1. The term *Baltic*, which connotes the three countries of Estonia, Latvia, and Lithuania, is common usage. Obviously, however, many other countries (including Russia) border the Baltic Sea, and Poland, with its long Baltic Sea coastline, is certainly a key player in any NATO-Russia scenario. The use of the term *NATO Baltic* refers here to Estonia, Latvia, and Lithuania.

2. US Department of Defense, *Sustaining U.S. Global Leadership: Priorities for 21st Century Defense* (Washington, DC: Office of the Secretary of Defense, January 2012), http://archive.defense.gov/news/Defense_Strategic_Guidance.pdf.

3. Catherine Dale and Pat Towell, *In Brief: Assessing the January 2012 Defense Strategic Guidance* (*DSG*), CRS Report for Congress R42146 (Washington, DC: Congressional Research Service, 13 August 2013), 1.

4. US Department of Defense, *Sustaining U.S. Global Leadership*, 2.

5. Ibid., 3.

6. Robert Legvold, "Managing the New Cold War: What Moscow and Washington Can Learn from the Last One," *Foreign Affairs* 93, no. 4 (July/August 2014): 74.

7. Matthew Rosenberg, "Joint Chiefs Nominee Warns of Threat of Russian Aggression," *New York Times*, 9 July 2015.

8. US Department of Defense, *Sustaining U.S. Global Leadership*, 4–5.

9. Stephen M. Walt, "NATO Owes Putin a Big Thank-You," *Foreign Policy*, 4 September 2014, http://foreignpolicy.com/2014/09/04/nato-owes-putin-a-big-thank-you/.

10. "Remarks by President Obama to the People of Estonia" (Washington, DC: White House, Office of the Press Secretary, 3 September 2014), https://www.whitehouse.gov/the-press-office/2014/09/03/remarks-president-obama-people-Estonia.

11. "Wales Summit Declaration," NATO, 5 September 2014, http://www.nato.int/cps/en/natohq/official_texts_112964.htm.

12. For example, see Luke Coffey and Daniel Kochis, "The Baltic States: The United States Must Be Prepared to Fulfill Its NATO Treaty Obligations," Heritage Foundation, 29 September 2015, http://www.heritage.org/research/reports/2015/09/the-baltic-states-the-united-states-must-be-prepared-to-fulfill-its-nato-treaty-obligations.

13. "Operation Atlantic Resolve Fact Sheet 2014 and 2015," United States European Command, 29 January 2015, http://www.eucom.mil/operation-atlantic-resolve.

14. "EUCOM Provides Update on the European Reassurance Initiative," United States European Command, 20 April 2015, http://www.eucom.mil/media-library/article/33026/eucom-provides-update-on-the-european-reassurance-initiative.

15. "News Transcript: Joint Press Conference with Secretary Carter, Lithuanian Minister of Defense Oleskas, Latvian State Secretary of Defense Sarts and Estonian Minster of Defense Mikser in Tallinn, Estonia," Department of Defense, 23 June 2015, http://www.defense.gov/News/News-Transcripts/Transcript-View/Article/607062.

16. Lara Seligman, "US F-22s Arrive in Europe," *DefenseNews*, 31 August 2015.

17. Senate, *Hearing of the Defense Subcommittee of the Senate Appropriations Committee: Air Force Posture Hearing*, 113th Cong., 2nd sess., 2 April 2014, http://www.ngaus.org/sites/default/files/TRANSCRIPT-%20SAC-D%20Air%20Force%20Posture%20Hearing%202APR14.pdf.

18. Michael Kofman, "Putin's Strategy Is Far Better Than You Think," *War on the Rocks*, 7 September 2015, http://warontherocks.com/2015/09/putin-is-a-far-better-strategist-than-you-think/.

19. The definitive work is Donald E. Lewis et al., *A Perspective on the USAFE Collocated Operating Base System*, RAND Note N-2366-AF (Santa Monica, CA: RAND Corporation, July 1986), http://www.rand.org/content/dam/rand/pubs/notes/2007/N2366.pdf.

20. See Lt Col Robert D. Davis, "Forward Arming and Refueling Points for Fighter Aircraft: Power Projection in an Antiaccess Environment," *Air and Space Power Journal* 28, no. 5 (September–October 2014): 5–28, http://www.airpower.maxwell.af.mil/digital/pdf/articles/2014-Sep-Oct/F-Davis.pdf; and Maj Gen Charles Q. Brown, Jr., Brig Gen Bradley D. Spacy, and Capt Charles G. Glover III, "Untethered Operations: Rapid Mobility and Forward Basing Are Keys to Airpower's Success in the Antiaccess/Area-Denial Environment," *Air and Space Power Journal* 29, no. 3 (May–June 2015): 17–28, http://www.airpower.maxwell.af.mil/digital/pdf/articles/2015-May-Jun/SLP-Brown_Spacy_Glover.pdf.

21. The minimum requirement is a 6,000-feet x 75-feet hard-surface runway. Weight-bearing capacity is also relevant for C-17 operations but is not specified and probably is not a factor in the cases involved here. See Davis, "Forward Arming and Refueling Points," 14–15; and AirportNavFinder, accessed 18 June 2015, http://airportnavfinder.com. The airfields include Estonia (Ämari, Tallinn, and Pärnu), Latvia (Jūrmala, Lielvārde, Daugavpils, Liepāja, and Riga), and Lithuania (Vilnius, Kaunas, Šiauliai, Pajuostis, and Palanga). Any potential NATO FARP airfield, of course, would need to be technically evaluated. Several of these airfields are civilian airports, and three are their respective country's international airports. Finally, under desperate circumstances, some abandoned airfields not included here could be pressed into service.

22. Robert Farley, "Five Russian Weapons of War NATO Should Fear," *National Interest*, 6 July 2014, http://nationalinterest.org/feature/five-russian-weapons-war-nato-should-fear-10816.

23. Brown, Spacy, and Glover, "Untethered Operations," 20, includes a figure showing notional ballistic missile threat rings centered well inside Russia (on or near Moscow), giving the appearance that the Baltic countries are outside Russian SRBM range, which is not the case.

24. Luis Simón, "Assessing NATO's Eastern European 'Flank,'" *Parameters* 44, no. 3 (Autumn 2014): 67–79.

25. Ibid., 73.

26. Stephen Blank, "What Do the Zapad 2013 Exercises Reveal? (Part One)," *Eurasia Daily Monitor* 10, no. 177 (4 October 2013), http://www.jamestown.org/single/?tx_ttnews%5Btt_news%5D=41449&no_cache=1#.VWNR1EtgMYU.

27. Andres Kasekamp, *A History of the Baltic States* (New York: Palgrave Macmillan, 2010), 192.

28. Ibid., 192–93.

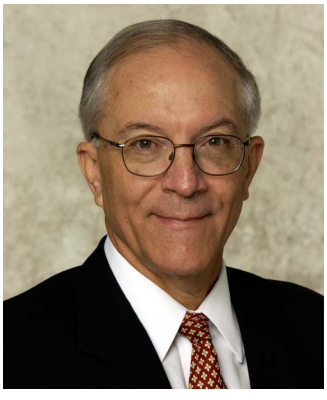
29. Ian Davis, "NATO to Increase Baltic Air Patrols," NATO Watch, 9 April 2014, http://www.natowatch.org/node/1456. In addition to NATO's own Airborne Warning and Control System aircraft, France contributed an aircraft, and other air forces provided air-refueling assets.

30. "A Key Air Training Event for NATO in the Baltics," Supreme Headquarters Allied Powers Europe, 2 April 2014, http://www.aco.nato.int/a-key-air-training-event-for-nato-in-the-baltics-wraps-up.aspx.

31. "NATO VJTF (Spearhead) Exercise Noble Jump Media Access, 9–18 June 2015," Supreme Headquarters Allied Powers Europe, 19 May 2015, http://www.aco.nato.int/exercise-noble-jump.

32. A true wild card in any such scenario is the possibility that Belarus, long a close ally of Moscow, either would join Russia in an attack against NATO or would permit Russian forces to transit its territory, thus exposing another flank for Polish and NATO defenders. Although unlikely, geography affords NATO the defensive depth it would need to counter such a move while bringing its own forces forward.

33. Robert Person, "6 Reasons Not to Worry about Russia Invading the Baltics," *Washington Post*, 12 November 2014, https://www.washingtonpost.com/news/monkey-cage/wp/2015/11/12/6-reasons-not-to-worry-about-russia-invading-the-baltics/.



Dr. Ralph S. Clem

Dr. Clem (BA, San Diego State College; MA, PhD, Columbia University) is Emeritus Professor of Geography at Florida International University, where he was also director of the Center for Transnational and Comparative Studies. His research and publications focus on the political geography of countries of the former Soviet Union as well as on Eurasian geopolitics. Dr. Clem was in the Air Force on both active and Reserve duty, serving as an intelligence officer for three flying units, a strategic air analyst at the National Security Agency, and the mobilization assistant to the commander, Air Intelligence Agency. He retired from the Air Force Reserve in 2004 as a major general.

The Joint Force Air Component Commander and the Integration of Offensive Cyberspace Effects

Power Projection through Cyberspace

Capt Jason M. Gargan, USAF

Cyberspace can provide great opportunities to assist the joint force air component commander (JFACC) in the field. This article explains how the JFACC can best understand, integrate, and command and control (C2) offensive cyber operations into a war plan to produce effects necessary for the mission. The idea of a few keystrokes neutralizing the enemy's integrated air defenses will mesmerize just about everyone. Instead of employing a pricey kinetic weapon against a target, a cyber operator can simply take it out at the proper time and place—in theory. Offensive cyberspace operations have the potential to provide these types of power-projecting effects in the battlespace, but how can the JFACC gain access to, integrate, and C2 offensive cyberspace operations?

The direct connection between those operations and the JFACC continues to be a substantial focus area. This article proposes a solution—one that will work within the constraints of the 2013 Joint Staff Execution Order on "Implementing Cyberspace Operations Command and Control." This order defines two C2 frameworks that are important to comprehending the rest of this study: the direct support model (the current model) and the operational control (OPCON) model, both of which were defined as part of a transitional approach to allow for the maturation of command relationships, authorities, and buildup of operational capacity.

In the direct support model, integration of offensive cyberspace operations is best understood by examining forces presented in the cyberspace domain as a peer component to the air, land, and maritime components. That said, the air component is supported by offensive cyberspace operations forces from the cyberspace component (currently OPCON to the combatant-command-aligned Joint Force Headquarters–Cyberspace). These combatant-command-aligned offensive cyberspace operations forces offer new opportunities for the JFACC to achieve air component effects and objectives in the battlespace. Understanding OPCON of cyberspace operations forces is key for all components within a joint force because the latter have objectives that could be attained through the offensive cyberspace operations mission area. Ultimately, this means that the JFACC does not own (and will not

own) offensive cyberspace forces (even in Air Force uniforms) but will be supported by what eventually will become the joint force cyberspace component commander (in the OPCON model).

To effectively integrate offensive cyberspace operations, the JFACC must be familiar with available cyber forces, cyberspace guidance, and the proposed liaisons outlined in this article. Cyberspace planning and execution factors will not be foreign to the JFACC. Cyberspace planning doctrine is modeled after air planning doctrine but incurs its own domain-specific planning, target development, and execution considerations. The article further explains the importance of forces, guidance, and liaisons to show how offensive cyberspace operations can be integrated into the rest of the air campaign.

Cyberspace Guidance

To fully integrate offensive cyberspace effects, a JFACC must grasp the cyberspace capabilities that need to be planned, coordinated, and executed to support the joint air operations mission. Where and when does the JFACC require some degree of cyberspace superiority? The classic answer to this question is, "It depends." Planning factors include the phase of the campaign, the JFACC's objectives that support the overall mission priorities of the joint force command, and the combatant command's available cyber forces. Cyberspace operations must be cohesively fused into the air component's planning efforts if they are to benefit its mission. Consequently, the JFACC should create operational-level guidance for supporting cyber forces. According to Joint Publication (JP) 3-30, *Command and Control of Joint Air Operations*, "Proper recognition and integration of these [cyberspace] force capabilities during planning and execution is essential."[1]

The operational-level guidance on offensive cyberspace is issued through the standard means for joint air operations—the joint air operations directive and the air operations directive—thus ensuring that it receives proper attention from the JFACC and that the requested effects either fulfill or support the overall objectives of the air component. After the requested effects become viable for cyberspace action (i.e., access exists, authorities are granted, capabilities are matched to the target, and forces are available), the air operations directive must include the appropriately worded tactical objectives, tasks, and measures of performance and effectiveness for the intended time period of execution. In some cases, the task will support a tactical objective that already exists—that is, the objective includes tasks that could be executed by airborne assets as well as offensive cyberspace assets. By including the planned cyberspace effects in the air operations directive, the JFACC will receive feedback through the normal cycle processes of joint targeting, thereby integrating offensive cyberspace operations into the JFACC's standard preexisting processes. Although an effect through offensive cyberspace would likely be executed closer to the onset of conflict, that action does not prevent air component planners from thinking of effects that could be delivered as options to deter an adversary from increasing aggression.

One planning consideration regarding the use of cyberspace rather than airborne assets is the lead time necessary to generate intelligence for the offensive cyberspace effects. Target development should be requested much earlier than that for a traditional airborne target and should have a longer-term focus. More often, full target development takes weeks, months, or years instead of days.

Cyberspace Forces

As mentioned, knowledge of available forces and their organization is a major part of the planning process and the integration and C2 of cyberspace operations. Depending upon the situation, the JFACC can leverage joint cyber forces to provide offensive effects in support of the air component's objectives. The current C2 framework—the direct support model—has key offensive cyberspace operations organizations that can coordinate and conduct those operations: the combatant command's joint cyberspace center, Joint Force Headquarters–Cyberspace, and the offensive cyberspace operations tactical units, including the combat mission team and combat support team (see the figure below). Each JFACC should take time to study the progress that his or her respective combatant command has made with respect to establishing the joint cyberspace center's mission.

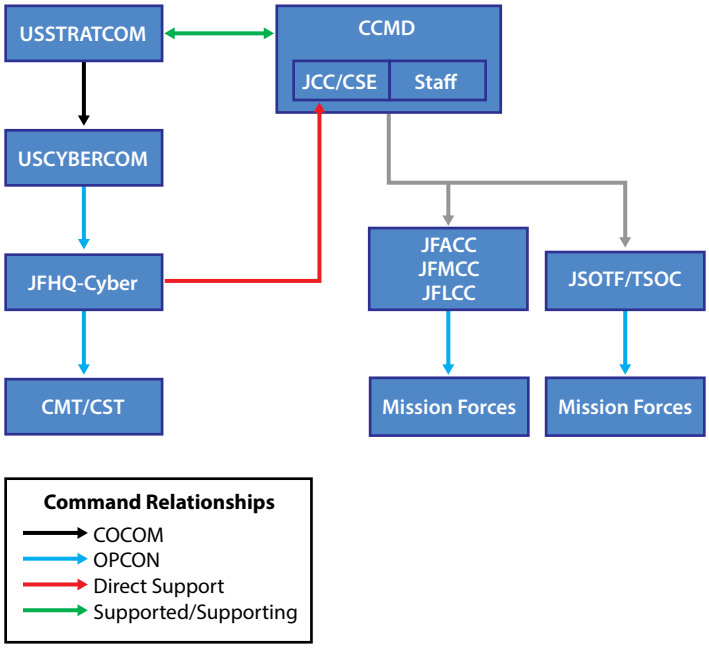


Figure. A combatant command's offensive cyberspace forces in the direct support model

USSTRATCOM - US Strategic Command
USCYBERCOM - US Cyber Command

JFHQ-Cyber - Joint Force Headquarters–Cyberspace
CMT/CST - Combat Mission Team / Combat Support Team
CCMD - Combatant Command
JCC/CSE - Joint Cyberspace Center / Cyberspace Support Element
JFACC - Joint Force Air Component Commander
JFMCC - Joint Force Maritime Component Commander
JFLCC - Joint Force Land Component Commander
JSOTF/TSOC - Joint Special Operations Task Force / Theater Special Operations Command
COCOM - Combatant Command (Command Authority)
OPCON - Operational Control

Joint Cyberspace Center and Cyberspace Support Element

The joint cyberspace center is responsible for the three lines of cyberspace operations: Department of Defense (DOD) information network operations, defensive cyberspace operations, and offensive cyberspace operations, including regional, national, and allied capabilities supporting the combatant commander's objectives. Additionally, the center is tasked to coordinate, integrate, and synchronize cyberspace operations and effects with those operations in the other war-fighting domains within the combatant command. The joint cyberspace center receives direct support from US Cyber Command's (USCYBERCOM) cyberspace support element. Each combatant command's joint cyberspace center has an associated cyberspace support element that fulfills the direct-support relationship and reaches back to USCYBERCOM.

Joint Force Headquarters–Cyberspace

As a part of the Cyberspace Mission Force, and as defined in the Joint Staff execution order, USCYBERCOM designated each service's cyberspace component (the Air Force example is AFCYBER) a Joint Force Headquarters–Cyberspace and directed each one to support specific combatant commands. These headquarters provide cyberspace domain expertise, enabling the supported combatant command staff to integrate the necessary operational- and tactical-level cyberspace planning activities into operational plans. Additionally, Joint Force Headquarters–Cyberspace executes OPCON to the tactical firing units known as combat mission teams and combat support teams, which are aligned to specific target sets within their respective combatant commands. The joint cyberspace center, cyberspace support element, and Joint Force Headquarters–Cyberspace establish unity of command and unity of effort for the combatant commander's (or joint force commander's, if established) cyberspace operations through direction of the attached combat mission and support teams.

Combat Mission Team / Combat Support Team

Combat mission teams concentrate on combatant commander's objectives and project power in and through cyberspace while combat support teams offer analytical and developmental support to combat mission teams. Under both C2 frameworks, to leverage the combat mission teams' capabilities, air component planners must

request cyber effects that support the JFACC's objectives. Just as there are a limited number of aircraft, so are there a limited number of combat mission teams and combat support teams. As a result, every request made by the air component may not be immediately pursued. The joint cyberspace center reviews and validates all requests by the components to ensure not only that the effect supports the respective component's objectives but also that the request is one which the combatant commander wishes to dedicate the constrained resources of his or her combat mission team and combat support team towards pursuing. Clearly, the JFACC must be certain that cyberspace planners coordinate closely with their respective joint cyberspace center.

Director of Cyberspace Forces

The current push from the Air Force entails setting up a position with a familiar name: director of cyberspace forces, working for the JFACC. There are many issues with the establishment of this position, the most notable of which is that it runs counter to the Joint Staff execution order defining coordination authority within the joint cyberspace center (direct support model) or the joint force cyberspace component commander (OPCON model) since the name implies that it has that coordination authority, as do other similar positions.

The director of cyberspace forces was originally Air Forces Central Command's solution to supporting the air and space operations center with cyberspace operations. The command modeled the director of cyberspace forces after the director of space forces and the director of mobility forces. This position was intended to give the commander, Air Force forces a senior expert for cyberspace operations. While Air Forces Central Command authored the concept in June 2014 to establish a director of cyberspace forces, the Joint Staff began standing up the Cyberspace Mission Force with the release of the previously mentioned 2013 Joint Staff Execution Order "Implementing Cyberspace Operations Command and Control."

In a joint task force, the JFACC is normally delegated space coordination authority from the joint force component commander.[2] In that instance, the director of space forces is the primary adviser to the JFACC on space operations. In a joint force, each component knows to find the director of space forces to coordinate space requirements for the joint area of operations. So although the director of space forces works for the JFACC, that individual provides "space-enabled effects to the [joint task force] based upon [joint force component] priorities."[3] Similarly, the director of mobility forces has a joint perspective and responsibilities to the joint force component for both internal and external air mobility operations. The director of mobility functions as a coordinating authority with all required commands and agencies for mobility operations. Once again, if a component in the joint force needs mobility expertise or advice, it knows to find the director of mobility forces. One other key note is that the director of space forces and the director of mobility forces are both recognized by joint publications, but the director of cyberspace forces is not.[4] JP 3-12(R), *Cyberspace Operations*, 5 February 2013, also makes no mention of the position.

The director of cyberspace forces position at the combined air operations center lacks the same coordination authorities that exist for the director of space forces and director of mobility forces. The latter two are joint-task-force-level positions and serve as lead advisers for their respective specialties. In Air Forces Central Command's situation, the director of cyberspace forces working for the combined force air component commander is not the joint-task-force-level lead for cyberspace operations; that is the role of the joint cyberspace center in the Cyberspace Mission Force construct. Additionally, the combatant command's joint cyberspace center receives direct support from the Joint Force Headquarters–Cyberspace, which in turn has OPCON over its respective combat mission teams and combat support teams.

Outside Air Forces Central Command, the director of cyberspace forces is now being championed. The question that hasn't been fully explored has to do with problems that will be solved by creating the director of cyberspace forces. What will be different or better when that director conducts his or her daily job? The position has no authorities with respect to offensive cyberspace operations missions as a part of the Cyberspace Mission Force; those authorities flow from USCYBERCOM through Joint Force Headquarters–Cyberspace to the combat mission team. Assuming that offensive cyberspace operations are the mission type that the JFACC cares most about, the director of cyberspace forces will only coordinate with the appropriate agencies to support the JFACC's requests for offensive cyberspace operations. The authorities of the director of cyberspace forces for defensive cyberspace operations and DOD information network operations are also lacking.

The identified problem that brought about this resurgent discussion of director of cyberspace forces is that the JFACC is not receiving an adequate level of support and integration from cyberspace forces. The director of cyberspace forces was identified as the answer to this problem, but the director is possibly only a small part of the solution. The true problem is larger than missing a "single face" for all things cyberspace. It is a classic organize, train, and equip issue for the air component. The Air Force must reassess where cyberspace professionals are placed in air and space operations center divisions, including cyberspace-focused intelligence professionals. The current construct, which places cyberspace professionals in a specialty team, is no longer sufficient to fully integrate cyberspace effects. To push the air component towards the ultimate goal of a multidomain operations center, planners of nonkinetic effects must be placed inside in the strategy; combat plans; combat operations; and intelligence, surveillance, and reconnaissance division. As long as the direct support model is in effect, liaisons from the joint cyberspace center and Joint Force Headquarters–Cyberspace must be brought into the air component to form the cyberspace operations coordination element, just as the Marine, Navy, and special operations forces send liaisons to integrate. Lastly, cyberspace planners in the air component lack the proper intelligence-driven planning systems. This work is still in progress and is not unique to the JFACC's operations.

Solution: The Joint Air Component Coordination Element

A proven way for the JFACC to coordinate with other component commanders' headquarters is the joint air component coordination element (JACCE). Sending a JACCE to the joint cyberspace center to support the JFACC's objectives will offer an Airman's perspective to the future cyberspace component and allow for enhanced planning, integration, and execution of offensive cyberspace operations missions. In his article "A Seat at the Table: Beyond the Air Component Coordination Element," Gen Mike Hostage, USAF, retired, advocates for not only sending a JACCE to joint force component organizations but also ensuring that his or her daily interactions, resources, and authorities are appropriate for the mission.[5] Therefore, the JFACC should ensure documentation of the JACCE's authorities that are sent to the joint cyberspace center. The JACCE will receive support from the air component's cyberspace planners within the divisions and staffs.

The idea of sending the JACCE to the joint cyberspace center (or the future cyberspace component) is the same as the air component sending JACCEs to other components. By applying a proven way to integrate air component operations, such as the JACCE, the air component will be better set up for success to integrate cyberspace operations for the JFACC while aligning organizationally and working within the constraints of the Cyberspace Mission Force. The JACCE is already charged with coordinating the integration of requirements as "airspace coordinating measures, fire support coordinating measures, close air support, air mobility, and space requirements."[6] Now cyberspace operations should be added to that list.

As previously addressed, the joint cyberspace center, in turn, should send cyberspace liaisons to the air component to integrate joint cyberspace operations. A major step in the center's maturation process is coordinating with components. A cyberspace operations liaison element sent to the air component to plan and integrate joint cyberspace effects will only help. The element will carry out functions similar to those of the special operations liaison element, battlefield coordination detachment (Army liaisons), naval and amphibious liaison element, and Marine liaison officer, which already exist as recognized liaisons within the air component. The Air Force should focus and shape its cyberspace operations efforts through the JACCE, which, with a collection of cyberspace experts from all three cyber mission areas—DOD information network operations, defensive cyberspace operations, and offensive cyberspace operations—can then ensure that the JFACC's objectives and priorities are being met.

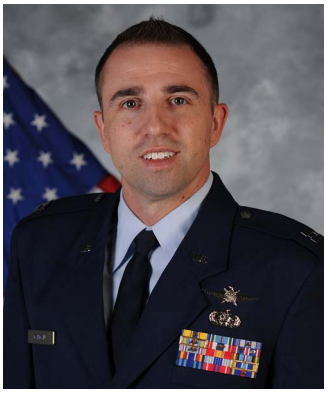
Conclusion

How can the JFACC gain access to, integrate, and C2 offensive cyberspace operations? He or she can do so by understanding the available cyberspace forces and requesting support from them, comprehending cyberspace guidance and the Joint Staff Execution Order on "Implementing Cyberspace Operations Command and Control," and setting the foundation for the JFACC to leverage offensive cyberspace operations through a JACCE to the joint cyberspace center (or cyberspace component). The JFACC can then fix manning within the air component to have cyber-

space planners in the proper divisions (and not in special teams) to link the requested targets and effects to JFACC objectives within the joint air operations plan and air operations directive, including cyberspace support from the joint cyberspace center. Finally, the JFACC can work with the joint cyberspace center and Joint Force Headquarters–Cyberspace to stand up the cyberspace operations liaison element within the air component to ensure proper understanding of the JFACC's objectives and areas where he or she can provide support. ✪

Notes

1. Joint Publication (JP) 3-30, *Command and Control of Joint Air Operations*, 10 February 2014, I-1, http://www.dtic.mil/doctrine/new_pubs/jp3_30.pdf.
2. JP 3-14, *Space Operations*, 29 May 2013, http://www.dtic.mil/doctrine/new_pubs/jp3_14.pdf.
3. Curtis E. Lemay Center for Doctrine Development and Education, "Director of Space Forces," in "Annex 3-14, Space Operations," 19 June 2012, [1], https://doctrine.af.mil/download.jsp?filename=3-14-D17-SPACE-OPS-DIRSPACEFOR.pdf.
4. JP 3-14, *Space Operations*; JP 3-30, *Command and Control of Joint Air Operations*; and JP 3-17, *Air Mobility Operations*, 30 September 2013, http://www.dtic.mil/doctrine/new_pubs/jp3_17.pdf.
5. Lt Gen Mike Hostage, "A Seat at the Table: Beyond the Air Component Coordination Element," *Air and Space Power Journal* 24, no. 4 (Winter 2010): 18–20, http://www.airpower.maxwell.af.mil/airchronicles/apj/apj10/win10/2010_4.pdf.
6. Curtis E. Lemay Center for Doctrine Development and Education, "The Joint Air Component Coordination Element," in "Annex 3-30, Command and Control," 7 November 2014, [1], https://doctrine.af.mil/download.jsp?filename=3-30-D29-C2-JACCE.pdf.



Capt Jason M. Gargan, USAF

Captain Gargan (BS, MS, Bellevue University) is chief of cyberspace integration and an instructor at the US Air Force Weapons School, Nellis AFB, Nevada. He is responsible for the integration of cyberspace and information operations into all weapons school exercises. The author of multiple offensive cyberspace operations courses, he instructs all students who attend the school on what cyberspace effects can bring to the battlefield. Captain Gargan recently returned from Air Forces Central Command's combined air and space operations center, where he stood up the cyberspace operations cell within the strategy division. As the first cyberspace weapons officer to deploy to Air Forces Central Command, he was responsible for a team that planned all offensive cyberspace fires in support of Operation Inherent Resolve against Da'esh terrorists. Prior to becoming a weapons school instructor, he was the chief of standardization and evaluation for the offensive cyberspace operation weapon system utilized by the Air Force's Network Attack System.

Book Reviews

To Kill Nations: American Strategy in the Air-Atomic Age and the Rise of Mutually Assured Destruction by Edward Kaplan. Cornell University Press (http://www.cornellpress.cornell.edu), Sage House, 512 East State Street, Ithaca, New York 14850, 2015, 272 pages, $39.95 (hardcover), ISBN 0801452481.

In *To Kill Nations,* Edward Kaplan, a history professor at the US Air Force Academy, covers the history of American strategy during the first 20 years of the Atomic Era—roughly the period from 1945 to 1964. The author poses two key questions. First, in light of the usability of atomic weapons, demonstrated on 6 and 9 August 1945, Kaplan asks how nuclear weapons came to be unusable through a strategy of mutually assured destruction (MAD). Second, he asks what the rise of MAD did to the Air Force and airpower thought in the United States. His answers lay out a number of key arguments. First, Strategic Air Command (SAC) planned to win a war with the USSR by using atomic weapons—a strategy that made sense, according to Kaplan. The Air Force's experiences during World War II suggested that nuclear weapons were the logical extension of a winning strategy—in other words, "If it ain't broke, don't fix it." Additionally, the author contends that during the early to mid-1950s, meaningful victory through nuclear war was possible because of numerous advantages that the United States enjoyed over the USSR. Finally, he points out that after 1960, the civilian leadership realized nuclear war was not winnable in any meaningful way and that SAC reluctantly acquiesced, trying to preserve the idea of such a strategy.

Kaplan outlines his argument in three parts, based on presidential administrations (those of Truman, Eisenhower, and Kennedy). In each one, he explores the operational/tactical realities and resulting military plans; US-declared and action policies; and the interservice politics or rivalries dealing with atomic policies, plans, budgets, and acquisitions. The book's organization is one of its key strengths insofar as it helps bring both clarity and simplicity to a complex and intellectually challenging subject.

The thesis and narrative of *To Kill Nations* lead Kaplan to a number of wide-ranging conclusions too numerous to mention here. However, it is important to note that his findings address airpower thought, Air Force identity, strategic studies, civil-military relations, Cold War history, and nuclear theory and strategy.

Broadly speaking, the focus of the study is US nuclear planning at the strategic and operational levels. Although some people may think that nuclear weapons are relics of the Cold War, that notion is far from reality. Given current developments both domestically and abroad, the historical analogies such as those provided by Kaplan are critical to Air Force officers serving in almost any capacity. At home, America's civilian military leadership wishes to reinvigorate the nuclear enterprise. Abroad, Iran, Russia, and North Korea offer compelling reasons for officers to think about nuclear strategy, operations, and planning. Nuclear deterrence will certainly remain an important part of any US strategy for dealing with Iran's nuclear program, and Russia's modernization of its nuclear arsenal in a bid to achieve superiority demands a response from the United States. Lastly, North Korea has not only tested nuclear weapons but also claims to have the means to deliver them to the American homeland. Kaplan's discussion of the US strategy for the USSR in the early to mid-1950s is an excellent analogy for the United States' situation with North Korea today.

Officers in both the Air Force and the joint force should read this book. For those serving in the Pentagon or at Strategic Command, its examination of the formation of US nuclear strategy is essential to an understanding of that strategy. Similarly, planners in the Middle East, Pacific, or South Korea will find *To Kill Nations* useful in comprehending the emerging Iranian and North Korean nuclear strategy. Additionally, it offers critical insights into how the Air Force might counter either Iranian or North Korean nuclear capabilities. Finally, all Air Force officers, as well as Air Force Academy cadets, will benefit from the book's presentation of a foundational part of the service's culture and thought, such as the ideas and actions behind strategic bombardment as embodied in SAC for 20 years.

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Presidents and Their Generals: An American History of Command in War by Matthew Moten. Belknap Press of Harvard University Press (http://www.hup.harvard.edu/), 79 Garden Street, Cambridge, Massachusetts 02138, 2014, 456 pages, $39.95 (hardcover), ISBN 978-0-674-05814-9.

In a very timely book, Matthew Moten tackles the relationship between our presidents, as commanders in chief, and the generals who served them. By putting forth a premise of "continuous negotiation" (p. 3) between a president and his military commanders, the author captures the interaction between policy maker and military strategist. Throughout the book, he returns to this continuous negotiation as the touchstone for his narrative of the most important political-military relationships in our history. Moten does a masterful job of telling the stories of significant presidents and generals throughout US history and ably folds in primary sources to add depth to both the personalities and the eras he explores. Although *Presidents and Their Generals* is a fantastic and interesting read, it is not without flaws. The author's West Point bias (he taught history at the academy) pervades the book as he focuses almost exclusively on Army generals, and the other services get short shrift. This partiality is understandable, but an Air Force audience will feel that luminaries like Gen Curtis LeMay and even our Navy brethren have earned more than a passing mention. Additionally, Moten's assessments of the relationships during the post-Vietnam era and his recommendations fall a little flat as the book moves from military history into the political realm.

The first of the book's three parts explains how precedents were set for these relationships and puts the reader on the path of the evolution of presidents becoming our most powerful military leaders as commanders in chief. Moten sets the scene by explaining how the American Revolution and especially George Washington influenced associations between the American military and the executive branch.

The author uses classic paintings by John Trumbull as images to capture how civilian leaders (and the people they serve) see the generals and how the generals see themselves vis-à-vis civilian leaders. Since the most important military leader of this era subsequently becomes president, the early part of this portion of the book concentrates more on the power that Congress held over military affairs. It is easy to forget that the balance of such affairs in our country is supposed to mirror the checks and balances of our political affairs. The first part takes us to the beginning of the Civil War, and Moten stresses the importance of how professionalizing the Army's officer corps—primarily with the rise of West Point—influenced the linkage between presidents and generals. As he points out, the lines are necessarily blurred between the policies laid out by the presidents and the strategies that the generals must use to realize the goals of the executive branch. One feels that a mandatory quotation

from Carl von Clausewitz belongs here, and neither Moten nor I disappoint: "War is not a mere act of policy but a true political instrument, a continuation of political activity by other means" (p. 172). The author makes the point extremely well by consistently showing how ineffective either partner can be by failing to grasp this aphorism.

Moten hits his stride in the second part, which, by itself, makes the book worth reading. He shows a master historian's hand by weaving in wonderful anecdotes and primary sources about Lincoln and his generals. Even after the passage of 150 years, readers can feel Lincoln's frustration with Maj Gen George McClellan and his refusal to act; moreover, readers root for both Lincoln and Grant even though the outcome is already well known. During this presidency, the role of commander in chief comes into its own, and Moten shows us how the conflict shaped both the presidency and the nation. Lincoln's use of his commanding generals as implements of his policy reverberated throughout American history. The author, however, does miss an opportunity to reinforce his point as he skips over the Spanish-American War and President William McKinley's deliberate decision to choose a former Confederate general, Joseph Wheeler, to lead the Army. Part two continues with brilliance, covering the unique mandate that Gen John Pershing enjoyed during World War I and delving into the relationship between two great leaders in FDR and Gen George Marshall during World War II. Here, Moten's strengths as a writer and historian are on display as he uses these great wars to show the back and forth of this "continuous negotiation" between presidents and generals in its highest form.

Part three juxtaposes the successes in collaboration of the previous part with the perils of mistrust between presidents and their commanders. Truman must deal with a rogue MacArthur in the Pacific, eventually firing a near demigod who then sadly sinks from the scene after a series of failed political ventures. Kennedy loses trust in his generals after the debacle of the Bay of Pigs and brings in an outsider, retired general Maxwell Taylor, who pushes a doctrine that drives policy during the Vietnam conflict. Moten then ends this part with an examination of the conflicts in Iraq and Afghanistan. He is rightfully critical of the administrations and their generals for their many missteps, but his critique of Colin Powell seems almost personal. Moten goes to great lengths to point out his shortcomings as an Army leader, and his criticism of the Powell Doctrine stops just short of referring to him as a modern-day McClellan. This part also blatantly omits a discussion of the Kosovo war and Operation Allied Force, which would have offered an exceptional opportunity to explore both a significant armed conflict fought almost exclusively from the air and the relationship between Clinton and Gen Wesley Clark.

Ultimately, *Presidents and Their Generals* is a tremendous read, and I highly recommend it. The author's writing style and deft historical storytelling make the book engaging and enjoyable—particularly the portions on the Civil War and World War II. Moten's minor missteps are easily overshadowed by the quality of the writing and relevance of the topic.

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Whitey: The Story of Rear Admiral E. L. Feightner, a Navy Fighter Ace by Peter B. Mersky. Naval Institute Press (http://www.usni.org/navalinstitutepress), 291 Wood Road, Annapolis, Maryland 21402, 2014, 224 pages, $39.95 (hardcover), ISBN 978-1-61251-791-9.

The colorful career of Rear Adm Edward Lewis Feightner, a great fighter pilot, is the subject of Peter Mersky's biography *Whitey: The Story of Rear Admiral E. L. Feightner, A Navy*

Fighter Ace. Admiral Feightner's time in service covers a significant portion of the history of naval aviation, during which the Navy transitioned from pre–World War II biplanes to some of the fastest and most capable jet aircraft that still serve in military air arms. Just about any aviator would admire the career of someone who was part of a community forged in the heat of aerial combat through four decades, participating in some of the most crucial conflicts that shaped our world. Full of numerous encounters with other notable pilots, *Whitey* weaves a story that envelopes the reader with the jocular, easygoing, but demanding environment of naval aerial warfare. In this regard, the book does well to use chance encounters with men who would go on to become flag and general officers as a conduit for conveying Admiral Feightner's stellar career as he flew, fought, and became a key proponent in the development of fighter aircraft from World War II through the mid 1970s.

Despite this sterling source material, Mr. Mersky's book presents neither a complete nor cohesive picture of its subject. At 224 pages, including notes, bibliography, and index, it reads more like a casual conversation during which an individual recounts his memories and detours every time a name triggers a specific memory. Mersky never gives the reader enough information to develop a full picture of the man, glossing over his time before entering the military in just four pages and dedicating only five additional pages to his days as a student naval aviator prior to receiving his wings and orders to his first squadron. There is no solid foundation for learning about Ensign Feightner as he begins training to become a fighter ace and an outstanding flag officer. Significant in terms of the scope of time covered but sketchy in personal details, the text examines Admiral Feightner's service in the Pacific theater from the battle of the Philippine Sea through the battle of the Solomons and the end of the war; however, much of it is reserved for the actions of individuals other than Feightner.

The account of his activities after the war also tends to jump around in time. A description of a mishap during the Detroit National Air Races in 1951 suddenly switches to a passage about the Reno National Air Races in 1964 and then to a P-51 Mustang mishap in 2011. Next is a passage about a horrific accident during an air show in June of 1972 when the US Air Force Thunderbirds and US Navy Blue Angels flew F-4s. Again, though, the author offers scant detail about any effect this event had on Admiral Feightner. Also lacking are descriptions of the challenges of life in the military with his wife, Vi, or of raising his nephew Jim McBride. The few sentences and photos of their wedding and of Mr. McBride's commissioning leave the reader wanting more information about the subject's life. This jumping around in time without proper context for doing so confuses readers, depriving them of a good sense of the cohesive roles that Admiral Feightner played in many historical events. It is as if the author sat down with the subject and took voluminous notes but either lost or didn't number them. Mersky expects the reader to know the names, times, and locations that he mentions in passing, assuming that any deficiencies in the book will be offset by our collective memories.

Some sections describe aircraft programs that were not a direct part of Admiral Feightner's history. They appeal to readers' general interest in aviation, but they neither reveal nor describe the man. One section relates in some depth a story about how the admiral worked on various innovative programs, such as one involving an attempt to build a supersonic seaplane-based fighter—the Consolidated XF2Y Sea Dart. Even after addressing a number of situations in which test pilot Feightner cheated death or brought home disabled aircraft against incredible odds, Mersky concludes by merely observing that "Whitey never had a chance to fly these interesting new types" (p. 97). Again, the author does little to fully develop a portrait of the man.

Despite its shortcomings, *Whitey* is a fascinating book for readers interested in learning about a driving force in the development of Navy fighter aviation and the Pacific theater of aerial warfare. Rather than a riveting and colorful biography of a larger-than-life individual, it hints at the possibility of a much more in-depth and captivating story. Readers leave it

with the impression that it could have been part of a more comprehensive effort that chronicled the life of another member of the "greatest generation"—one that revealed the impact of their lives and decisions.

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The Centenary History of Australia and the Great War, vol. 1, **Australia and the War in the Air** by Dr. Michael Molkentin. Oxford University Press: Australia & New Zealand (http://www.oup.com.au/), 253 Normanby Road, South Melbourne, Victoria, 3205, Australia, 2014, 288 pages, $99.00 (hardcover), ISBN 978-0-19-557679-5.

The Great War, a monumental clash among nations, utilized paradigm-shifting weaponry at the beginning of the twentieth century, resulting in unfathomable carnage and suffering. The brutality of this new era of warfare saw rapidly changing doctrines and strategies that sought to capitalize on newly developed weaponry for offensive and defensive purposes. One such weapon—the "aeroplane"—played a fundamental role in changing strategies, operations, and tactics. Leading the charge for airpower and its employment in the battlespace was Great Britain. The British Empire and dominions within the Commonwealth heralded this call to war across all branches, including the development and creation of the Royal Flying Corps (RFC) and Royal Naval Air Service (RNAS), which eventually merged, creating the Royal Air Force (RAF) in early 1918. *Australia and the War in the Air* is the first of five volumes in The Centenary History of Australia and the Great War series, devoted to a historical account of the First World War written from an Australian-centric view. This volume seeks to provide context of how Australian airmen served the British Empire, whether in the RFC, RNAS, RAF, or Australian Flying Corps (AFC) along the western front and in the Middle East.

Author Michael Molkentin had originally written this manuscript as a PhD dissertation and then expanded its scope and depth with the assistance of funding from his university and the Australian Army. That said, Molkentin provides a comprehensive and scholarly review of how the Australian public and military became interested in aviation for defensive purposes (e.g., concern over Japanese hostilities) and offers details about initial grassroots efforts to develop and organize aviation and flying schools in Australia during the war. Throughout the text, he shows how a lack of funding, infrastructure, training, logistics, and support staff consistently undermined Australia's efforts at fielding (and maintaining) its own flying squadrons for the British Empire. Nevertheless, such efforts (as well as the failed Gallipoli Campaign) were vital to facilitating Australian identity and eventual independence.

Most of the text is devoted to thorough examinations of major air-ground battles along the western front, the failed British campaign in Mesopotamia, and the British push from Egypt into Palestine. Showing how aircraft were initially used for aerial reconnaissance and artillery spotting, Molkentin describes how leadership in each region adopted varying tactics to employ aircraft based on climate, terrain, and logistics. As the war progressed, technology permitted aircraft to engage in air combat, and tactical close air support evolved into ground strafing and trench strafing, including opportunistic bombing, mapping, and other reconnaissance. By the war's end, aircraft were air-dropping ammunition and other war matériel to rapidly advancing troops on the battlefield. Finally, one of the author's most interesting discoveries from his investigation of airmen's diaries and official memos is that the term *ace* (denoting a pilot with five air-to-air kills) was never used by airmen serving in the British

Empire. He finds that *ace* was invented in the late 1920s by cinema and that such a term would have been considered "vulgar" (p. 159) by pilots had it existed during the Great War.

Given that this text was underwritten by the Australian military, many readers may find it skewed toward Australian airmen and their role in aviation operations across the western front and the Middle East. Even more distracting are the author's randomly placed anecdotal stories of Australian airmen involved in each operation—stories that rarely provide a causal link to outcome. Nevertheless, Molkentin does redeem himself on numerous occasions by dispelling commonly held beliefs about exaggerated Australian contributions to the Great War—for example, an analysis of the performance of Australian and British aviation units shows them to be comparable in combat, among other metrics. Furthermore, the author makes a strong case that Australia's desire to create its own air force significantly undermined the overall war effort—mainly attributed to the remoteness of the continent and a lack of organic industrial capability to build aircraft. Finally, the text does an admirable job of reassessing the great airpower theorist Marshal of the RAF Hugh Trenchard and his application of airpower along the western front. This examination highlights his poor decisions concerning organization of the flying squadrons and his blind commitment to strategic bombing. Conversely, Molkentin praises Trenchard for his overall belief in unrelenting offensive operations through decentralized execution at the squadron level. Such airpower doctrine, he finds, was decisive in gaining air superiority over the German *Luftstreitkräfte* (German Air Force).

The author wrote this book for the sole purpose of appreciating Australians who served in a flying or aviation support role in the RFC, RNAS, RAF, and AFC. Regardless of its focus, it effectively demonstrates many origins of the modern-day uses of airpower, describing how its role developed and evolved as aircraft capabilities grew by leaps and bounds during the Great War. Readers with an appetite for discovering insights into Commonwealth military aviation and its "birth pains" will appreciate *Australia and the War in the Air* for its in-depth analysis of World War I campaigns that utilized airpower. This book is also notable for its rejection of many notions of airpower's decisiveness during some major battles of the Great War. Molkentin is candid about this assertion in assessments of each side, finding (through diaries and official correspondence) that airpower was mostly decisive in undermining enemy morale and disrupting the organization of ground troops. Military leaders will appreciate *Australia and the War in the Air* for its ability to identify issues that still face airmen when they deploy aircraft and personnel to a combat zone.

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Ghost Fleet: A Novel of the Next World War by P. W. Singer and August Cole. Houghton Mifflin Harcourt (http://www.hmhco.com/), 222 Berkeley Street, Boston, Massachusetts 02116, 2015, 416 pages, $28.00 (hardcover), ISBN 9780544142848; 24 May 2016, $14.95 (softcover), ISBN 9780544705050.

Arguing for one's ideas regarding tomorrow's warfare through narrative fiction is a time-honored tactic among defense futurists. The *Space Wars* and *Counter-Space* novels by William Scott, Michael Coumatos, and William Birnes are relatively recent additions to the genre dealing with Air Force topics. Perhaps one of the best known examples is Hector Bywater's 1925 novel *The Great Pacific War*, which was remarkably (though not perfectly) accurate in describing World War II in the Pacific 15 years later. Not as well known is that Bywater, a top naval writer of his time (and spy, but let's not stray), wrote a nonfiction book in 1921 called

Sea Power in the Pacific, which described many of his views. Presumably concerned with the lack of readership of his factual tome, Bywater couched his argument in a fictional story. History would tend to validate his strategy: *The Great Pacific War* is over twice as popular on Amazon than *Sea Power in the Pacific*.

It appears that P. W. Singer is following in Bywater's footsteps. His 2009 book *Wired for War* is a well-regarded nonfiction work in defense robotics. Singer's position as a strategist at the New America Foundation certainly qualifies him as a top defense writer. With *Ghost Fleet*, he and cowriter August Cole—an Atlantic Council nonresident senior fellow—grapple with how robotics and drones will change the battlefield of the near future.

However, *Ghost Fleet* is not simply about drones (though they abound!). Singer and Cole tackle many other issues such as deep-sea mineral exploration, the demise of the US dollar, the collapse of the Middle East and the global oil market, piracy, cyber war among national and private hackers for both espionage and destructive purposes, 3-D printing, space warfare, space tourism, Chinese microchips (and US reliance upon them), the utility of many modern weapons systems (the F-35, the US Navy DD[X] program, and others), the patriotism of companies publicly traded around the world, and the relative decline of the US as a global power. The authors confront these issues through a hypothetical "world war" (in reality, a Pacific war) between a Russia/China alliance and the United States for control of Hawaii and the greater Pacific. China presumably intends to gain control of a deep-sea mineral bed of immense wealth in nominally US sovereign waters, but its real ambitions aren't described much more deeply than a war necessary to secure China's "manifest destiny" in the world.

Unfortunately, this mechanical rationale for the next war is symptomatic of the book's clunky storyline. China's main strategist and "villain" is an admiral and connoisseur of Sun Tzu, but he reads as little more than a more willing Isoroku Yamamoto (complete with his own *Yamato*-esque battleship with a very unimaginative name) who follows Japan's playbook almost to the letter—with the exception of actually conquering Hawaii. The insurgency there takes center stage in the middle third of the book, interspaced with cataloging the preparations stateside to launch an inevitable US counterattack. The characters are wooden and not well developed; moreover, the conclusion is difficult to follow and ultimately unfulfilling. The story isn't really bad, but it isn't very polished either. However, in didactic fiction the story is simply the carrier of information.

Does *Ghost Fleet* deliver on its message to enlighten readers about modern warfare? Here the book earns a qualified yes. Singer and Cole describe many new battlefield technologies on the tactical level, plausible uses of those technologies, and the documentation necessary (over 20 pages' worth) for readers to learn more about the real-world basis of their wonders. The authors' depiction of America's weakness in space defense and in industrial policy (the one managed by the belief that whether America produces computer chips or potato chips is irrelevant) is strong. Their use of different types of combat robots is also at the level one would expect from national experts. Unfortunately, they also whitewash what may become a critical problem in twenty-first-century American warfare.

The authors appear to go out of their way to savage military decisions they don't like but are completely "politically correct" on social issues—and ham-fistedly so. A Chinese-American female character (the only one who can get America's superweapon to work) is convinced that the United States is going to put her in a concentration camp, and, sure enough, one of the handful of white male characters assaults her because he's convinced she's working for the Chinese. Singer and Cole could have at least introduced that possibility, especially since ethnic Chinese spies are not unknown today for stealing defense and industrial secrets on China's behalf (where are those footnotes?). Instead, they treat the reader to such inspired dialogue as occurs when one Navy chief scolds a white male sailor: "If we win, it'll be because of her. If we die, it's because of ass-hats like you!" (p. 209) In the real Pacific War, Japanese-

Americans were interned in camps, and a largely homogeneous American people fought for national honor after a sneak attack. In this fictional Pacific war, an invasion and occupation of an entire US state engenders no sizable ethnic tensions beyond those of (stupid and racist) white male enlisted sailors, and most young Americans care about the war only because China has jammed most of the Internet. This contrast is perfect fodder for serious exploration, but the authors don't touch these themes at all! Many readers will probably find the book's social preaching tedious and the unexplored dilemmas a lost opportunity.

Ultimately, *Ghost Fleet* is a decent book, fit as a novel for a long plane flight or a summer day at the beach. There is good stuff inside, but the packaging is a little weak. Readers should not be surprised if they can remember an interesting technology they might want to read more about but cannot recall the characters' names when they finish. Only time will tell if Singer and Cole are as successful with World War III as Bywater was with World War II.

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Smoke Jumper, Moon Pilot: The Remarkable Life of Apollo 14 Astronaut Stuart Roosa by Willie G. Moseley. Acclaim Press (http://www.acclaimpress.com), 820 North Main Street, Sikeston, Missouri 63801, 2011, 256 pages, $24.95 (hardcover), ISBN 978-1-935001-76-8.

In today's increasingly globalized and commercialized space environment, it has become normal for the American public to associate space exploration with the routine. During a listless era of discovery dominated by unexciting deep-space probes, lethargic Martian rovers, and heavily diminished manned orbital missions, modern society hasn't been able to maintain much enthusiasm for astronauts—former torchbearers of the exciting and complex "Space Race." Willie G. Moseley's *Smoke Jumper, Moon Pilot*, a fascinating biography of *Apollo 14* astronaut Col Stuart A. Roosa, seeks to reinvigorate the public's fading interest in the achievements of astronauts by providing a comprehensive look into the life of an exemplary American hero and patriot.

Stuart "Stu" Roosa was born in 1933 to an Army Corps of Engineers surveyor and his wife. His father's job required the family to travel extensively throughout the dense forests of the American West, consequently instilling in Roosa at a young age a lifelong love of nature (he would later take western tree seeds on the *Apollo 14* mission to germinate as "moon trees"). A highly intelligent and driven youth, Roosa completed high school in Oklahoma and enrolled at Oklahoma State University, eventually finishing his degree at the University of Arizona. During his summer breaks from college, Roosa worked for the National Forest Service in Oregon as a "smoke jumper," a specially trained firefighter who would jump from an airplane to extinguish isolated forest fires. He was a motivated and capable fireman, but such jumps only enhanced Roosa's growing interest in aviation. Consequently, after graduating from college, he enrolled in the Air Force's now-defunct aviation cadet program to become a pilot. After completing pilot training, Roosa flew various fighter aircraft such as the F-84F Thunderstreak, F-100D Super Sabre, and F-101 Voodoo before being chosen as a member of the Aerospace Research Pilot School's Class 64C at Edwards AFB, California. After his certification as a test pilot, Roosa managed the Air Force's flight-test program, highlighting himself as a leading candidate for the "Group 5" astronaut selection board. Ultimately, he was accepted along with other future moon voyagers such as Fred Haise, Ken Mattingly, and Jack Swigert.

At NASA, Roosa helped engineer the rocket engines on the *Saturn V* launch vehicle before being reassigned to the main flight-control center in Houston. There, he became a flight

controller for the doomed *Apollo 1* ground test and the *Apollo 9* space-test missions, paving the way for his own future spaceflight. Because of his exemplary performance, Roosa was selected as the command module pilot for *Apollo 13*, but the crew was swapped with *Apollo 14*'s to give the mission's commander, Alan Shepard, America's first man in space, more time to train. On 31 January 1971, *Apollo 14* lifted off for a nine-day journey to the moon and back. After the successful mission, the Apollo space program began to experience budget cuts and was ultimately scrapped after the flight of *Apollo 17*. Not interested in *Skylab* and the space shuttle program, Roosa eventually retired from NASA and the Air Force, going into private business and devoting his remaining years to his passion for the outdoors and hunting. He died in 1994 and is buried in Arlington National Cemetery with his wife, Joan.

As expected, Moseley spends most of the biography on Roosa's time with NASA, allotting many pages to his only spaceflight on *Apollo 14*, his efforts on the *Apollo 16* and *17* backup crews, and his work as a flight controller on other manned missions. The author provides an in-depth analysis of the *Apollo 14* operation from start to finish, describing in detail the preflight training, the launch and transit to the moon, the lunar landing, Roosa's scientific experiments in solo orbit around the moon, and the return to Earth. The hefty amount of information about the mission, never before covered in a biography (crewmate Ed Mitchell would release his autobiography on the same topic in 2014), is striking and comparable to Michael Collins's industry benchmark *Carrying the Fire* (Cooper Square Press, 1974). In addition, by focusing on Roosa's other roles with NASA—not just his astronaut duties on *Apollo 14*—Moseley paints a vividly clear picture of the inner workings of that organization during the Apollo program, another rarity for biographies of Apollo astronauts.

The book draws on a variety of dependable sources to piece together Roosa's life but relies most heavily upon his friends and colleagues from the test-pilot and astronaut programs, including *Apollo 14* crewmate Ed Mitchell and *Apollo 16* moonwalker Charlie Duke. It also integrates the recollections of Roosa's children and family members, giving the biography a more personal touch and greater accuracy. Through a patchwork collection of stories, quotations, reprinted newspaper articles, and memories, Moseley brings Roosa back to life so that the reader can appreciate his personal accomplishments and his position in the space program. The book is a well-received effort and comparable to other great biographies I have read in the past. At a fast-paced 256 pages, it is a quick and informative volume, well worth the reader's time.

Smoke Jumper, Moon Pilot offers captivating insight into the history of the Apollo space program and one of its finest astronauts, Stuart Roosa. One of only 24 men to visit the moon, he served in nearly every position available to a NASA astronaut, thus putting his personal story on par with that of the Apollo program itself. Further, Roosa was an outstanding pilot, father, and patriot whose life continues to serve as an excellent example to younger generations of Air Force personnel. I encourage all readers interested in Colonel Roosa's life, the history of American spaceflight, and the lunar exploration program to read this engaging biography.

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To North Vietnam and Back Again: A Personal Account of Navy A-6 Intruder Operations in Vietnam by Ed Engle. Xlibris LLC (http://www.Xlibris.com), 1663 Liberty Drive, Suite 200, Bloomington, Indiana 47403, 2014, 212 pages, $19.99 (softcover), ISBN 978-1-49311-825-0.

People who have experienced the daring drama of the movie *Flight of the Intruder* and are expecting the same from Ed Engle's book *To North Vietnam and Back Again: A Personal Account of Navy A-6 Intruder Operations in Vietnam* perhaps should look for another book. The author presents a more down-to-earth perspective of naval operations in the end years of the United States' involvement in the Vietnam War. That said, the book still has considerable merit, as does the story that Engle presents to the reader. In essence he offers a glance into a somewhat normal career in the military and the opinions and viewpoints of a field grade officer. Readers will experience moments of sheer terror on missions into North Vietnam, yet much of the narrative resembles the standard autobiography of an engineer who became a bombardier and, ultimately, resumed his former career.

To North Vietnam and Back Again begins like any normal autobiography, detailing the author's early years and leading into his military service. It is always interesting to see the development of the author from childhood, for it creates a personal identification with that individual. Additionally, readers will be fascinated with the unconventional way Engle entered active flight service with the Navy. The time that retired lieutenant commander Engle spent in Vietnam represents the meat of the naval A-6 aircrew perspective of the war there. The book offers an abundance of technical information, providing a glimpse into the grit and grind of carrier deployment into the Vietnam area of responsibility. Throughout the author's years in Southeast Asia, he displays the same level of dedication, ingenuity, and bravery exhibited by all of the Navy A-6 crew members. Compared to the total length of the book, the section on Vietnam is surprisingly short, but at the same time, it is arguably the most interesting part. The final half of *To North Vietnam and Back Again* is a chronology of the remainder of Engle's career and his work for the US Navy during his postmilitary life.

The author constantly compares the Navy that he knew and loved to today's service, likening it to "going to the office and coming back again" (p. 52). Here he largely refers to the personal and squadron relationships throughout his naval career. Furthermore, Engle delves into an interesting argument and viewpoint that he describes as the "burst bubble" (p. 131) phenomenon. On multiple occasions, he points out how he would find or experience something about the Navy that would burst his bubble. Evidently, he has a set idea about what a bubble is, for, in truth, it is a relative term. Engle boldly points out what he considers errors made by Navy commanders and leadership concerning decisions that he observed in both his wartime and peacetime careers. This point of view from a line naval aviator is both fascinating and helpful.

Ultimately, *To North Vietnam and Back Again* has some merit to the academic world, offering excellent detail on technology and communication that affect current US conflicts, as well as a harrowing tale of Vietnam. Engle keeps the reader interested by utilizing an effective storytelling style of writing and by including both stock and personal photos throughout the book instead of including them all in a center section, as is the case with most autobiographies. Unfortunately, to the average Air Force officer, the book has limited usefulness in application since its focus is primarily naval and historical. Nevertheless, it is still worth reading because, unlike the average autobiographical work, it offers a unique perspective on events. Anyone could find enjoyment in this story of Engle's life by reading it with an open mind.

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Hell's Angels: The True Story of the 303rd Bomb Group in World War II by Jay A. Stout. Berkley Publishing, Penguin Group (http://www.penguin.com/meet/publishers/berkley/), 375 Hudson Street, New York, New York 10014, 2015, 464 pages, $27.95 (hardcover), ISBN 9780425274095; January 2016, 464 pages, $17.00 (softcover), ISBN 9780425274101.

In *Hell's Angels*, author Jay A. Stout challenges himself to write the definitive reference book about the Eighth Air Force and the critical operations that occurred in the skies over Europe during World War II. Many authors set similar goals for themselves, and most of them fail. Instead, Stout succeeds by incorporating accurate facts and figures from narratives of the men of the 303rd Bomb Group who were there. By doing so, he holds the interest of his readers, immersing them in the desperate struggle.

Crucially, Stout utilizes an inclusive approach to his study. Although the aircrews manned the planes and flew them into combat, they were but one part of a team that included ground crews and support staff. Additionally, the author weaves in the perspectives of the enemy's military personnel and civilians. This holistic method places readers directly in the flow of information and allows them to determine how all elements influence each other. Stout proceeds chronologically, reviewing the 303rd from its inception through combat operations, thus presenting a unique view of the unit's evolution and utilizing it as a case study representative of European air operations as a whole.

Critical areas in this work are hard to come by. The sheer volume of data can initially appear daunting, but the author's presentation and development of personal connections permit that same data to be digested and circumstantially applied. Further, his establishment of context and his development of relationships among key figures, units, and locations give readers an appreciation of the gravity of what is being said, allowing them to draw their own conclusions.

Given the subject of the European air war, Stout easily could have buried his story in facts or specific narratives, but his skill as a writer shines through in this regard. By developing scenarios with historical context, incorporating the firsthand experiences of veterans, and then reviewing the actions via his own analysis and that of historians, the author builds a resource that supports learning on multiple levels. This methodology demonstrates a framework that satisfies and engages both recreational readers and professional academics alike.

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